



Loureiro Engineering Associates, Inc.



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United States Environmental Protection Agency
New England
One Congress Street
Suite 1100 (HBT)
Boston, MA 02114-2023

Per H & Whitney
CTD9906720081
R9
RDMS # 100 505

Attn.: Mr. Juan A. Perez
Ms. Kim Tisa

RE: Remedial Action Work Plan
Willow Brook and Willow Brook Pond
Response to November 13, 2001 EPA Comments

Dear Mr. Perez and Ms. Tisa:

We have prepared this letter on behalf of our client, United Technologies Corporation, Pratt & Whitney Division (UTC/P&W), to provide responses to each of the comments raised by the United States Environmental Protection Agency (US EPA) in a November 13, 2001 memorandum with regard to the *Remedial Action Work Plan, Revised October 2001 (RAWP)*

This letter is formatted to provide each of the comments followed by the response to the comment in italics. In those instances where a response to a previous comment resulted in a response of other than "response is acceptable", the original EPA comment has been presented and EPA's supplemental comment has been underlined, and the response to the supplemental comment has been provided in italics. Submitted with this letter is one copy of the revised RAWP text and all of the respective tables that have been revised in accordance with the responses provided. Please substitute this revised material for the text and tables included in your existing RAWP. In addition, two Standard Operating Procedures are included for inclusion into Appendix B of your existing RAWP.

1. Page 17, 3rd complete paragraph, last sentence - For clarification, §761.79(c) contains no provisions for decontamination of water; the correct citation is §761.79(b). P&W removed the original reference for decontamination of water and incorporated the reference with decontamination of field sampling equipment. This is incorrect. The original comment applied directly to decontamination and discharge of water containing PCBs and the §761.79(b) reference should be cited. The correct citation for decontamination of field sampling equipment is §761.79(c). RAWP should be revised for accuracy.

The RAWP has been revised for accuracy. The revised RAWP text is included in Attachment 1.

8. Page 31, Miscellaneous Sampling - It appears that P&W is proposing to characterize debris generated from demolition activities after demolition has occurred. In the event that any



of these materials have been in contact with PCB-containing material, characterization must occur prior to demolition, not after. The requirement to dispose of PCB contaminated wastes based on the "as-found" criteria applies to all PCB-impacted materials, not just soils and sediments. Response is acceptable. I do recommend EPA Concrete Sampling Procedure for sample collection. Attached is a copy of this SOP.

The provided SOP has been reviewed against the LEA SOP entitled Concrete Chip Sampling and found there to be no substantive differences between the two documents. A copy of the LEA SOP has been provided in Attachment No. 2.

15.d Page 35 indicates that aqueous PE samples will be collected for each suite of analytes; Page 53 indicates that four PE soil samples will be submitted. P&W's May 31, 2001 response also indicates aqueous PE samples will be used rather than soil. Response is acceptable, however, EPA would have recommended that solid PE samples be used rather than aqueous since the samples to be analyzed are solid matrices rather than aqueous.

We appreciate the comment and have, for the reasons noted in our previous response, elected to utilize aqueous PE samples rather than solid PE samples. Should solid PE samples become available that allow for a double blind submittal to a laboratory, we would implement the use of such samples on this or future projects.

21. Having three (3) tables labeled 4-1 is confusing. It would be helpful if the tables were renumbered in some fashion since these are separate tables. Response is acceptable. The following comments relate to newly revised Table 4-2 and 4-3:

a. EPA understands that the number of samples shown in Table 4-2 represents an estimate and that actual numbers may vary in the field based on judgmental sampling or additional areas that are found to require cleanup. However, Note #6 of Table 4-2 doesn't appear to coincide with the number of samples shown (estimated to be collected) in this table.

*Note #6 refers to only the **composite** samples to be analyzed for PCBs and is the sum of the estimated number of PCB sidewall composites (54) and PCB bottom composite samples (67). The sum of which is 121. Note #7, refers specifically to the **grab** samples to be analyzed for PCBs and accurately reflects the sum of the bottom (40) and sidewall (36) grab samples. The sum of which is 76. The total estimated number of confirmatory samples (composite and grab) to be analyzed for PCBs is 197.*

i. Note #6 indicates that a total of 121 PCB composite samples will be collected. Upon review of the table, the following PCB composite samples are found: 67 bottom composites and 54 sidewall composites. This represents a total of 119 samples not 121. Please check and revise if required.

See first portion of response to Comment No. 21.a. above.

b. Table 4-3 summarizes the extraction and analytical methods that will be employed. This table does not coincide with the information presented in Table 4.1 as follows:



Though somewhat redundant, Table 4-1 has been revised to provide a complete list of the analytical methods presented in Table 4-3. Table 4-3 has been modified to address the specific comments provided in the table provided in the November 13, 2001 memorandum. The revised tables are included in Attachment 3.

22. Table 4-2 - Numbers specified for COCs other than PCBs are not correct. For example the frequency for collection of field duplicates is 1/20; with a total of 74 samples the number of field duplicates should be 4, not 2. Please check all numbers and revise accordingly. This table is now Table 4.4. Response is acceptable, however, Note #3 is confusing. QA/QC samples should be associated with the confirmation samples rather than the disposal samples. The estimated sample quantities do correspond to those numbers indicated on Table 4-2 which relates to confirmatory sampling. However, this Note infers otherwise. Please clarify.

The note has been revised to correctly indicate that QA/QC samples will not be collected for disposal characterization samples. The revised table is included in Attachment 3.

31. K.T. Specific Comment 20 - In its response, P&W indicates that the RAWP was revised to provide for a 4-point composite sample representing 1,600 square-foot area. As in EPA's original comment, P&W provides no justification for this approach. Justification is required that would support this type of sampling scheme. Reference to the Verification Sampling Guidance Manual is not sufficient. This document was to support EPA's PCB Spill Cleanup Policy which is not applicable at this site. Response is acceptable with proposed density sampling and biased sampling. However, EPA would suggest that in the event adjacent composite samples show wide COC concentrations, that denser and/or grab samples be collected in those areas to insure that cleanup standards have been met.

Adjacent composite samples exhibiting a wide spread in concentration will be evaluated for additional characterization. This evaluation will also consider the magnitude of concentration exhibited in the composite sample in comparison to the remediation goal for a given area.

33. K.T. Specific Comment 27 - P&W's response includes reference to 3540C or 3541 as extraction methods for this project. This is inconsistent with the information provided in Table 4-1. EPA does suggest that 3550 may not be a sound method for sediments due to the high organic content of the materials which could lower the PCB extraction efficiency for this method. Response is acceptable, however, response refers to Table 4-1 for extraction methods and it appears that the methods are in Table 4-3. Please see comment #19, above.

The statement is correct. The response should have referred to Table 4-3.

34. Attachment 1 includes a revised Table 4.1. The methods listed should include references for all matrices of interest, including soils, sediments, water, and concrete. Response indicates that Table 4-1 was revised and includes methods for all matrices including soils, sediments, water, and concrete. Please be aware that while the methodology is the same as soils/sediments, concrete was not included in Table 4-1. Further, this table is inconsistent with Table 4-3 as noted in Comment 21.b., above.



Table 4-1 has been revised to provide specific reference to analytical methods for concrete. The revised table is included in Attachment 3.

35. Revised Table 4.1 also appears to contain errors in the referenced methods. For example 3510C is a separatory funnel liquid-liquid extraction procedure, which does not appear to be applicable to soils and sediments. Method 352C0 does not exist to EPA's knowledge. See previous comment (#34, above).

Table 4-1 has been revised to address this comment. The revised table is included in Attachment 3.

36. Confirmatory sampling within the wetland areas appear to have changed such that the grid sampling is comprising a larger area. As discussed in previous correspondence, EPA is concerned over the # samples/area given the heterogeneity of the PCB distribution in this area. Accordingly, unless P&W can provide a sound justification for its sampling scheme, this sampling approach (grid size/sample) is not acceptable in the wetlands and a smaller sampling spatially will be required. Response is acceptable, with exception of suggestion noted in #33, above.

As this comment refers to sampling density, it is assumed that the supplemental comment underlined above refers to Comment No. 31, rather than No. 33. Please refer to the response to Comment No. 31, above.

44. Page 18, Process Water Buildings, 1st paragraph - The 2nd to last sentence indicates 3 different cleanup standards for utilities. It is unclear how/where these numbers were derived. The 10 $\mu\text{g}/100\text{ cm}^2$ is the cleanup standard for non-restricted use of non-porous surfaces; however, 1 $\mu\text{g}/100\text{ cm}^2$ and 25 $\mu\text{g}/100\text{ cm}^2$ are not TSCA cleanup standards. Further the text implies that a direct comparison of surface concentrations to bulk concentrations exists for cleanup determinations; this is incorrect. The only comparison for wipe to bulk concentrations is found at §761.1(a)(3) which was put in place for purposes of determining if PCB cleanup is needed when no liquids are present. Please revise this paragraph for accuracy and clarity.

The paragraph has been revised for accuracy and clarity and references to standards of 1 and 25 $\mu\text{g}/100\text{ cm}^2$ have been eliminated.

45. Page 33, Sample Collection [for PCB confirmatory samples], There appears to be a procedural step missing from the analytical bullet. Prior to extraction of the sample by the laboratory, the sample aliquot must be dried either in a low-temperature oven or at ambient temperature in a desiccator. Please add step to procedure. The laboratory should also have an SOP for this which should be referenced here.

Per the §761.3, the definition of "Dry Weight" provides that "...or other processes or combinations of processes which would remove water but not remove PCBs from the sample" and also provides that "Analytical procedures which calculate the dry weight concentration by adjusting for moisture content may also be used." In the analysis of samples, the laboratory has elected to utilize diatomaceous earth for the purposes of absorbing moisture present in the soil



sample prior to extraction and analysis and calculating the dry weight concentration by adjusting for moisture content following extraction and analysis. Following numerous conversations with the laboratory, we are confident that the procedures being employed during sample preparation, including homogenizing the sample prior to selection of a 10-gram sub aliquot for analysis, followed by the addition of diatomaceous earth, followed by extraction and analysis will result in the removal of water that is reproducible and is applicable to measuring PCBs in the sample matrix at the concentration of concern.

These conversations, coupled with the facts that: 1) confirmatory sampling is being performed in a manner to ensure representative samples of material remaining following remediation are collected; 2) the laboratory is making every effort to obtain a sub aliquot that is representative of the sample submitted; 3) remediation is resulting the removal of nearly all organic-rich sediment; 4) the confirmatory samples collected to date range in moisture content from 8 to 42 to an average of 21 percent and samples collected in the future will exhibit similar moisture contents; 5) and the laboratory is consistently achieving extraction efficiencies of greater than 80 percent, we conclude that the methods being employed meet the intent of all applicable portions of the federal regulations pertaining to this remediation and that the methods will result in the collection of data that will, following achievement of results below the 1 and 25 ppm goals established for the site, support an overall risk-based decision that the remediation of the area subject to the RAWP has been complete.

We respectfully request your concurrence with our conclusion.

46. Page 38, Field Duplicate Samples - The 3rd sentence indicates that absorbent pads may be used to absorb standing water from samples. EPA suggests that P&W use caution if this procedure is employed. If soils are placed on absorbent pads, not only could the pads absorb water, but the pads could potentially absorb any oils that may be adhering to the soil particles. As a result, this could potentially effect the PCB concentration of that sample.

Should it be necessary to utilize absorbent pads, only pads that will absorb water will be utilized. Pads that have an affinity for both oil and water will not be permitted. However, it should be noted that the dewatering being performed during the project has resulted in conditions that do not require the placement of soils on absorbent pads. Every effort will be made to fully dewater an area prior to sampling and eliminate the need for the use of absorbent pads.

47. Based on my conversation with Brian Cutler on November 8, 2001, it appears that additional materials may exist that require decontamination that have not been included in the RAWP. For example, Section 2.3.2 includes a new discussion on utilities. It appears that in addition to utilities, sheet metal may also be present that would require either removal or decontamination. This needs to be included in the discussion and a reference for the wipe sampling SOP should also be included. P&W may also need to revise any associated tables to incorporate surface (e.g. wipe sample) determinations.

The RAWP has been revised to provide more specific reference to the types of materials that will be encountered during the implementation of remediation. These materials include sheeting, shoring, pipes, conduits, and concrete abutments. Specific details have been added to Sections



4.0 and 5.0 of the RAWP text to define the activities associated with non-porous material and concrete sampling and analysis. Revisions have also been made to the respective tables as appropriate. In addition, an SOP for wipe sampling (for non-porous materials) has been included. The revised RAWP text and tables are included in Attachments 1 and 3 respectively. The SOP for wipe sampling is included in Attachment 2.

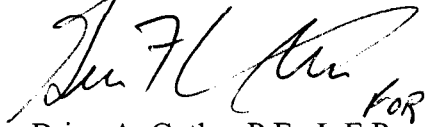
48. Table 5-3, Note 4 indicates that precision/accuracy values may change for the project as they will be dependent upon the selected laboratory. This is acceptable provided that the selected laboratory can give you results that are acceptable and that will assist in insuring data validity. As discussed previously, normally the parameters are established by the project team based on site objectives. In many cases, the laboratory's acceptance criteria is sufficient. In some cases, however, some project teams may require more stringent (e.g. tighter) controls.

We have provided recommended precision/accuracy values for the purposes of defining overall expectations and have afforded the laboratory the opportunity to provide us with their achievable precision/accuracy values for comparison. Based on a review of the laboratory provided values, we are confident they will be capable of meeting the project objectives and they are sufficient.

We hope that the above responses and the attached revised pages of the RAWP adequately address your comments and meets with your satisfaction. Should you have any further questions or comments, please do not hesitate to contact Lauren Levine of UTC at (860) 728-6520 or me.

Sincerely

LOUBEIRO ENGINEERING ASSOCIATES, INC.


Brian A. Cutler, P.E., L.E.P.
Vice President

Attachments

cc: Lauren Levine, UTC
Elsie Patton, DEP, w/o enclosure and attachments
Richard Hathaway, DEP
Janet Kwiatkowski, DEP, w/o enclosure and attachments
Melissa Toni, DEP, w/o enclosure and attachments
Cori Rose, ACOE, w/o enclosure and attachments
Ernest Waterman, U.S. EPA, w/o enclosure and attachments

Attachment No. 1
Revised RAWP Text

REMEDIAL ACTION WORK PLAN

**United Technologies Corporation
Pratt & Whitney
Willow Brook and Willow Brook Pond
East Hartford, CT**

November 2000

Revised December 2001

Prepared for

**UNITED TECHNOLOGIES CORPORATION
PRATT & WHITNEY
400 Main Street
East Hartford, CT 06018**

Prepared by

**LOUREIRO ENGINEERING ASSOCIATES, INC.
100 Northwest Drive
Plainville, CT 06062**

LEA Comm. No 88UT002

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1.0 INTRODUCTION

1.1 General

This Remedial Action Work Plan (RAWP) has been developed to present the approach and strategy for the remediation of Polychlorinated Biphenyl (PCB) contaminated sediment within Willow Brook and Willow Brook Pond at the United Technologies Corporation (UTC), Pratt & Whitney (P&W) manufacturing facility in East Hartford, Connecticut (Site). A Site Location Map is included as Figure 1-1. The remediation approach consists of the excavation and offsite disposal of soil and sediment from within and immediately surrounding Willow Brook and Willow Brook Pond that contains PCBs at concentrations greater than 25 milligram per kilogram (mg/kg or parts per million (ppm)).

Following excavation, a geotextile, soil and rock cap (engineered control) will be installed over the entirety of Willow Brook Pond and the open channel of Willow Brook from Willow Brook Pond to Main Street. The exceptions to this approach is the wetland downgradient of the dam where excavation of soil at concentrations greater than the Residential Direct Exposure Criteria for PCBs will be performed and the area backfilled and planted to restore the wetland, and the footprint of the process water facility where soil will be remediated to meet the Residential Direct Exposure Criteria for PCBs for soils within 4-feet of the final grade, the Commercial/Industrial Direct Exposure Criteria for PCBs for soils located in inaccessible locations and the GB Pollutant Mobility Criteria for soils above the seasonal high water table, prior to the placement of backfill. This particular alternative necessitates a variance to the criteria of the Remediation Standard Regulations (RSRs). In accordance with 22a-133k-2(f)(2)(A) and (B) of the Regulations of Connecticut State Agencies (RCSA), a request to use an engineered control (Request for Variance) was submitted to the Commissioner of the Connecticut Department of Environmental Protection (CTDEP) in January 2001 and was subsequently revised in response to CTDEP comments in May 2001. This report, coupled with the May 2001 revision of the January 2001 Request for Variance, have been prepared to satisfy these requirements. The Request for Variance is incorporated herein by reference.

Following remediation, the open channel of Willow Brook from the pond to Main Street will be restored to the current configuration. In response to a request by the Department of Environmental Protection (DEP) staff, the Willow Brook stream channel will be slightly modified between the dam that impounds Willow Brook Pond and Main Street to reduce the slope of the banks to control potential erosion and to modify the character of the channel bottom to create a low flow channel with pools and eddies. Willow Brook Pond will be restored to the current configuration. The proposed sediment cap will be installed throughout the pond bottoms. Due to the thickness of the cap (3-feet) and based on the proposed sediment removal volume, the final bathymetry within the ponds will be slightly modified to accommodate the proposed cap section.

The limits of the project are defined in two separate areas (upstream of the dam and downstream of the dam) and each area in two separate parts. The limits of the project area upstream of the dam is defined in two parts, Willow Brook Pond and the area of the former oil/water separator. The project area downstream of the dam is defined in two parts, the stream channel of Willow Brook Pond and the wetland area. It is recognized that the potential exists that contamination may exist outside these project limits. However, the intent of this remediation project is to address soil and sediment within and immediately surrounding Willow Brook and Willow Brook Pond. Measures to address contamination beyond those limits described below would be addressed in the future as separate projects.

1.1.1 Upstream of the Dam

Willow Brook Pond: With one exception, the lateral limit of the project area of Willow Brook Pond, inclusive of the small embayment west of the Process Water Facility and the footprint of the process Water Facility, is defined as the horizontal location of the ordinary water level (reference Drawing 1-1). The single exception is the location east of the upper section of Willow Brook Pond in the vicinity of a single soil boring WT-SB-132 (see Appendix A). The project area encompasses this boring to the limits shown on Drawing 1-1. Remediation, if necessary, beyond the limits shown will be performed as a separate project.

Former Oil/Water Separator: The lateral limits of the project area in the vicinity of the former oil/water separator is currently defined as the lateral limit of soils containing PCBs at concentrations greater than 25 ppm. However, it is recognized that the potential exists that PCBs and other constituents may exist in soils outside this lateral limit that would require remediation as part of the project. The current estimate of the lateral limits of the project in this area are depicted on Drawing 1-1.

1.1.2 Downstream of the Dam

Stream Channel Cap: The lateral limit of the project area for the stream channel cap is the 10-year flood elevation (22.0 to 24.0 feet above mean sea level) as shown on Drawing 1-1).

Wetland Area: The lateral limit of the project area for the wetland is currently defined to the south by the northern limit of the stream channel cap and to the north, east and west as the lateral limit of soils containing PCBs at concentrations greater than the Residential Direct Exposure Criteria. The lateral limits of these areas are also depicted on Drawing 1-1.

As discussed subsequently in this section, semi-volatile organic compounds, petroleum hydrocarbons and select metals were also detected in soil and sediment within and immediately surrounding Willow Brook and Willow Brook Pond. These constituents are commingled with soil and sediment containing PCBs. These constituents will remain in place in those areas in which they are commingled with soil and sediment containing less than 25 ppm PCBs and will be rendered inaccessible with the geotextile, soil and stone cap.

In summary, the components of the remediation approach include:

- The excavation and installation of a temporary lined by-pass channel with inlet and outlet structures;
- The demolition of the existing process water facility building structures and the offsite disposal of construction demolition debris;
- The removal and offsite disposal of the former oil/water separator located between upper and lower Willow Brook Pond and the excavation and complete removal of the structure with offsite disposal of impacted soil and concrete and the placement of an engineered control to achieve compliance with the variance provisions in the RSR;
- The excavation and offsite disposal of approximately 8,500 cubic yards of soil and sediment containing total PCBs at concentrations greater than 25 ppm from within and immediately surrounding Willow Brook and Willow Brook Pond;

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- The excavation and offsite disposal of approximately 1,500 cubic yards of soil and sediment containing PCBs at concentrations between 1 and 25 ppm from within and immediately surrounding the wetland area located north of Willow Brook;
- The excavation and offsite disposal of approximately 2,500 cubic yards of soil and sediment from within the open channel of Willow Brook to allow for the installation of the geotextile, soil, and stone cap within the stream channel;
- The placement of a geotextile, soil and stone cap (engineered control) over the entirety of the excavated area (with the exception of an approximately 1-acre wetland described below and the footprint of the process water facility) to isolate sediment containing less than 25 ppm total PCBs commingled with semi-volatile organic compounds, petroleum hydrocarbons, and select metals to achieve compliance with the variance provisions in the RSR;
- The restoration of an approximately 1-acre wetland located downstream of the Willow Brook Pond Dam; and
- The implementation of two institutional controls consisting of 1) an Environmental Land Use Restriction to ensure the affected area will not be used for residential purposes and to prohibit excavation; and 2) installation of a fence around the entire area to preclude access to Willow Brook and Willow Brook Pond.

1.2 Background Information

The UTC/P&W facility is located at 400 Main Street in East Hartford, Connecticut, and is approximately 1,100 acres in size. P&W initiated aircraft engine manufacturing operations in East Hartford in December 1929. Current site operations are conducted in a 6.5 million square foot complex and include administration and management, manufacturing, testing, research and development and ancillary services. All of these activities take place in the western portion of the 1,100-acre property. The Rentschler Airport and the Klondike Area occupy the eastern portion of the property. P&W previously used these two areas as an airport and a storage/testing area, respectively.

The Willow Brook and the Willow Brook Pond remediation area is about 4 acres in size as depicted in Drawing 1-1. The site is within a mixed residential, commercial, and industrial area of East Hartford, Connecticut. Property usage in the vicinity of the proposed RA area includes the following:

- UTC/P&W parking facilities and the Rentschler Airport, to the east;
- Apartment complex and residential areas to the north;
- A commercial business, parking facilities, and UTC/P&W manufacturing to the south; and
- Predominantly commercial areas with some residential to the west (across Main Street).

1.2.1 Site Description

Willow Brook is a small stream transecting the UTC/P&W facility from the northern portion of the Rentschler Airport through to the northwest portion of the current UTC/P&W operations complex. Willow Brook flows in a southwesterly direction in an open channel from the Rentschler Airport, is then hard-piped underground to the inlet of Willow Brook Pond, and continues from the pond as an open channel to a culvert under Main Street. From Main Street, Willow Brook flows in an open channel for a distance of approximately 2,500 feet to the confluence with the Connecticut River (see Figure 1-1). Willow Brook Pond is a man made water body located in the northern portion of the Site (See Drawing 1-1). The pond, a single body of water when first created, has been modified various times through the years. It is now comprised of two ponds subdivided by a culvert.

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Known water discharges to surface water that have existed at one point in time or another at the P&W East Hartford Facility include Discharge Nos. 001 through 015. The principal discharge from the facility is Discharge 001. Discharge 001 is the discharge of effluent from the dilute wastewater treatment plant at Colt Street. The other water discharges are permitted through the National Pollutant Elimination System (NPDES) program and are comprised mostly of cooling water and stormwater runoff. Only Discharge Nos. 001 through 004 and 007 through 009 are or were associated with Willow Brook or Willow Brook Pond. These discharges contained basement dewatering, industrial waters and process wastewater. Some of the discharges to the pond were routed through an oil/water separator. A map showing site wide discharge locations was previously provided in the *Work Plan for Willow Brook and Willow Brook Pond PCB Investigation*, prepared by LEA and dated December 12, 1997.

The majority of the water historically drawn from Willow Pond was used in buildings as a source of process water. The water was then collected and rerouted back to Willow Pond via NPDES discharge 003 and 004 and the Willow Brook via NPDES discharge 002. Historically water has discharged through the Experimental Test Airport Laboratory (ETAL) to Willow Brook upstream of Willow Pond. Basement dewatering operations and industrial waters had discharged through an oil/water separator into the brook. This building has been demolished and the oil/water separator water was removed.

During routine draining of Willow Brook Pond in September 1997, an oil sheen was noticed seeping through the sediment. P&W reported the sheen to the United States Coast Guard and the CTDEP in accordance with discharge reporting requirements. Following the detection of PCBs in a sample, the CTDEP issued P&W a NOV, No. PCB 97-08, on November 7, 1997. In response to the NOV, UTC/P&W developed a sampling work plan and conducted three phases of remedial investigation from December 1997 to April 1999. These investigations identified the probable sources and provided the analytical data to sufficiently define the horizontal and vertical limits of contamination allowing development of a remediation plan.

1.2.2 Physical Setting

Physiography

The UTC/P&W East Hartford facility lies within the Central Lowland province of Connecticut, a north-south trending valley system, which is approximately 20 miles wide at East Hartford. The valley system consists of a series of parallel valleys separated by linear north-south trending ridges. The Connecticut River flows southward just west of the site and drains the northern part of the valley system, ultimately discharging to Long Island Sound. The Connecticut River Valley, which is 5 to 6 miles wide and flat (local relief on the order of 30 feet), has created a broad floodplain and eroded terraces in the flatter portion of the valley system. The central portion of the Connecticut River Valley was occupied during deglaciation of the area by a large glacial lake. This lake, known as Glacial Lake Hitchcock, was formed during the northward retreat of the last continental ice sheet and existed about ten thousand years ago.

A regional drainage divide between the Connecticut River Basin and Hockanum Regional Basin lies to the north of the site and approximately 3 miles to the east of the site. The Hockanum River is a tributary of the Connecticut River.

Surface Water

From a review of the "Water Quality Classifications Map of Connecticut," published in 1987 by the CTDEP, surface water quality in Willow Brook has been designated as "B" along its entire reach to the

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confluence with the Connecticut River. As noted, the Willow Brook/Connecticut River confluence is approximately 2,500 feet from the Main Street culvert. The "B" designation indicates Willow Brook is known or presumed to meet water quality criteria for recreational use, fish and wildlife habitat, agricultural and industrial supply, and navigation. The Connecticut River has been designated "SC/SB." This designation indicates that the water quality in the river does not presently meet class "SB" water quality criteria for one or more designated uses, but the goal is to meet class "SB" criteria. Designated uses for class "SB" include potential for certain fish and wildlife habitat, recreational boating, industrial supply, and other legitimate uses including navigation.

Storm water

Surface water drainage in the immediate vicinity of Willow Brook and Willow Brook Pond is predominantly overland sheet flow. Storm water in the adjacent plant area is handled by a number of catch basins, roof drainage systems, and storm drain pipelines, which discharge directly into Willow Brook or through an oil/water separator prior to discharge to Willow Brook. The Flood Insurance Rate Map, prepared by the Federal Emergency Management Agency and dated October 23, 1981, for East Hartford, Connecticut (Community No. 090026 0003-D Panel 3 of 4), shows the projected 100-year floodplain of the Willow Brook area. Most of the flood-prone areas depicted along Willow Brook lie between the 100-year to 500-year floodplain.

Meteorology

The climate of central Connecticut is a cool, humid, modified oceanic type. Winters are long and moderately cool; summers are short and mild. The mean annual temperature is approximately 50 degrees Fahrenheit (°F), ranging from an average of approximately 28°F in January to an average of 73°F in July. The average annual precipitation of approximately 44 inches is fairly evenly distributed throughout the year (National Oceanic and Atmospheric Administration, 1990); snowfall is about 40 inches per year (Soil Conservation Service, 1962). The prevailing wind is from the south or southwest in spring and summer and from the north or northwest the rest of the year.

1.2.3 Regional and Site Geology

Regional Geology

The geology of the region consists of sedimentary and igneous bedrock overlain by unconsolidated sediments. The UTC/P&W East Hartford facility is situated in the central portion of the Hartford Basin of the Newark Terrain. The rocks of the Hartford Basin were originally deposited as sediments or as the result of volcanic activity in a rift valley setting. The bedrock stratigraphy consists of four terrigenous sedimentary rock formations: the New Haven, Shuttle Meadow, East Berlin, and Portland. These units are composed of interlayered reddish siltstones, sandstones, and conglomerates. The sedimentary formations are separated from each other by three laterally continuous basalt units: Talcott, Holyoke, and Hampden Basalts. The bedrock layers dip gently eastward and are crosscut by numerous steep faults.

The unconsolidated sediments in much of the region can be divided into three major units: glacial till and limited deposits of stratified sand and gravel, glaciolacustrine deposits, and post-glacial fluvial deposits. These three units were deposited in this order, with the till and the limited stratified sand and gravel deposits generally lying directly over bedrock.

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The till is poorly sorted and varies widely from a non-compact mixture of sand, silt, gravel, and cobbles with trace amounts of clay to a compact mixture of silt and clay with some sand, gravel and cobbles. The till is typically less than 10 feet thick in the vicinity of the UTC/P&W facility. The stratified sandy sediments (stratified drift) are much less extensive than the till and usually consist of sand, gravel and silt deposited by melt water in contact with or in front of the glacier. These sediments appeared to be of limited extent and occurred in relatively thin layers (less than 10 feet) beneath the UTC/P&W facility.

Glaciolacustrine deposits include both lake-bottom sediments consisting of silt and clay and sand and gravel deposits formed by beaches and deltas in the lake. Thicknesses of lacustrine clays and silts as great as 270 feet have been reported beneath the UTC/P&W facility. These deposits are thickest in areas of deep bedrock valleys, one of which trends north-south and underlies the Main Plant Area. In a few isolated cases, thin layers of gravelly sands have been documented within the deeper portion of the glaciolacustrine unit.

Post-glacial fluvial sediments generally consist of sand and gravel deposited as the Connecticut River flowed across the exposed lake bed and cut stream terraces into the exposed lacustrine clays and silts, creating stream terrace deposits. These deposits are laterally extensive over the UTC/P&W facility, and are typically 15 to 30 feet thick across the facility.

Site Geology

Bedrock beneath the UTC/P&W facility consists of red sandstone and siltstone of the Portland Formation. Depth to bedrock within the facility boundaries is over 300 feet in the Main Plant Area, and approximately 30 feet along the eastern property boundary. Near the western property boundary along the Connecticut River, depth to bedrock is about 150 feet. A north-south trending, buried bedrock valley underlies the UTC/P&W facility; this buried valley may have been a pre-glacial channel of an ancient river following a similar course to that of the Connecticut River.

A thin layer of glacial till, up to 10 feet thick, typically directly overlies bedrock. A gravelly sand stratified drift deposit has been reported above or in place of the till in a few isolated instances.

Glaciolacustrine lake bottom sediments occur over most of the UTC/P&W facility, and range in thickness from 9 to 270 feet. These deposits thicken towards the central part of the facility (near the Main Plant Area) and are generally absent near the eastern boundary of the site.

The deposits consist of laminated (varved) silts and clays with red fine sand partings. The color varies from gray near the surface to red at the base of the unit. The presence of local sand or gravel lenses within the glaciolacustrine unit near its base has also been reported, but these are not assumed to be laterally extensive.

Beneath the eastern portion of the site, the contact between the silt and clay and overlying sediments is distinct. However, in the Main Plant Area, an intermediate layer of fine sand and silt that varies in thickness from approximately 5 to 20 feet occurs between these two deposits. A similar zone may occur at the base of the glaciolacustrine unit as well; these zones are typical of depositional facies changes that are characteristic of the depositional environment (glaciolacustrine).

Post-glacial fluvial deposits on the UTC/P&W facility are floodplain sediments of the Connecticut River. As the river cuts a channel through the floodplain, terraces were formed along the banks. The stream terrace deposits occur across the facility and generally range from 15 to 30 feet in thickness. These

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deposits increase in thickness toward the central part of the facility where greater erosion of the top of the glaciolacustrine silt and clay may have occurred along a former (perhaps earlier post-glacial), abandoned channel of the Connecticut River. These deposits generally consist of uniform brown fine, or fine-to-medium, sand. More recently deposited laminated silt and sand (alluvium) occurs near the western boundary of the site. This alluvium is thickest near the Connecticut River and likely interfingers with the older stream terrace deposits. Other recent alluvial deposits are found scattered across the facility near existing and former streams or wetland areas.

1.3 Summary of Previous Investigations

This section presents a summary of the three previous phases of investigation conducted at Willow Brook and Willow Brook Pond from December 1997 to April 1999. A summary of the analytical results for the entire sampling program is included as Appendix A in a series of detailed site plans developed by LEA during the remedial investigation.

The investigations identified some probable sources and provided the analytical data to define the horizontal and vertical limits of contamination in sufficient detail to allow for the development of a remediation plan. Figures 1-2 and 1-3 present an overview of the delineation of the extent of PCBs in soil and sediment within and immediately surrounding Willow Brook and Willow Brook Pond.

Phase I: *Report on PCB Investigation for Willow Brook and Willow Brook Pond Sediment*, prepared by LEA, dated February 13, 1998. The purpose of this report was to present the findings of the PCB investigation conducted on Willow Brook and Willow Brook Pond sediment in order to address the requirements of item (1) of the third paragraph of the NOV, No. PCB 97-08 issued by the CTDEP and dated November 7, 1997. The sampling was performed in accordance with the *Work Plan for Willow Brook and Willow Brook Pond PCB Investigation*, prepared by LEA and dated December 12, 1997, and approved by the CTDEP on December 22, 1997.

The report describes the field activities performed based on a predetermined sampling grid and presents the analytical results of the investigations. A Toxic Substances Control Act (TSCA) sampling grid was developed to specify the number and location of samples for the investigation in accordance with USEPA's guidance document "*Field Manual for Grid Sampling of PCB Spill Sites to Verify Cleanup*". Two separate sampling grids were prepared for the east and west surface water bodies of Willow Brook Pond. The sampling was performed in accordance with the approved Work Plan, with the exception that the pond was not drained in response to CTDEP's concerns about sediment disturbance. Detectable PCB values on the sediment samples collected ranged up to a maximum concentration of 617 ppm total PCBs at sampling point WT-SD-33, located immediately downgradient of the subsurface connector between the eastern and western surface water bodies comprising Willow Brook Pond. Relatively high PCB concentrations were also observed in sediment samples collected in the vicinity of this location in both water bodies. Relatively elevated PCB concentrations were also observed along Willow Brook immediately downstream of Willow Brook Pond. A total PCB concentration of 327 ppm was observed in the sediment at location WT-SD-54. The results of the investigations indicated the presence of elevated PCB concentrations throughout Willow Brook Pond and in the section of Willow Brook between the pond and Main Street. The PCB concentrations observed beyond that point were below 1 ppm.

Selected sediment samples were also analyzed for volatile organic compounds (VOCs), semi volatile organic compounds (SVOCs), total petroleum hydrocarbons (TPH), and the RCRA eight metals (arsenic, barium, cadmium, chromium, mercury, lead, silver, selenium) plus nickel, zinc.

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Among the limited sediment samples analyzed for these parameters, elevated levels of SVOCs were detected in the sediment at location WT-SD-47 in the eastern water body of Willow Pond. Some of the highest SVOC concentrations reported in that sample included pyrene (480 mg/kg), phenanthrene (514 mg/kg), fluoranthene (537 mg/kg), chrysene (232 mg/kg), etc. Some of the highest metal concentrations observed in this location included lead (153 mg/kg), zinc (152 mg/kg), barium (37.7 mg/kg), and nickel (36.4 mg/kg), etc. The only VOC compounds identified in this location included trichloroethylene (23 µg/kg), tetrachloroethylene (11.6 µg/kg), 1,1,1-trichloroethane (9.7 µg/kg), and 1,1-dichloroethane (10 µg/kg). Generally lower SVOC and VOC concentrations were observed in the other locations samples.

Elevated TPH concentrations were observed at WT-SD-47 (1,160 mg/kg) and WT-SD-09 (4,340 mg/kg and 3,940 mg/kg in the duplicate). Relatively elevated metal concentrations were also observed at this location (zinc 772 mg/kg and 689 mg/kg in the duplicate, nickel 595 mg/kg and 593 mg/kg in the duplicate, lead 714 mg/kg and 691 mg/kg in the duplicate, chromium 490 mg/kg and 497 mg/kg in the duplicate).

It should be noted that no sediment was encountered in upstream accessible locations along the Willow Brook conduit to allow sample collection. Several manholes along the subsurface conduit were opened to confirm no sediment had accumulated within the conduit. Historical measurements have indicated non-detectable PCB levels in sediment samples collected from upstream brook locations, prior to the conduit.

Based on the results obtained, additional investigations were determined to be necessary to better characterize the vertical extent of the contamination within Willow Brook and Willow Brook Pond and to identify potential nearby sources of contamination.

Phase II: *Report on Supplemental PCB Investigation for Willow Brook and Willow Brook Pond*, prepared by LEA, dated April 1998. The purpose of this report was to present the findings of the supplemental PCB investigation conducted on Willow Brook and Willow Brook Pond. The supplemental soil and sediment sampling was performed to identify potential nearby sources of contamination and to provide information of the vertical extent of the contamination within Willow Brook and Willow Brook Pond. An overview of the investigation of the potential source areas and the delineation of Willow Brook and Willow Brook Pond sediments is as follows:

Southwestern bank of Willow Brook Pond: This area was investigated to determine if infiltration or seepage from historic sludge drying beds located to the south of Willow Brook Pond was a potential source. Four soil borings were also installed at the southwestern bank of Willow Brook Pond downgradient of the historic sludge drying beds. The borings were advanced to a depth of 20 to 24 feet from the western bank of the pond. Low total PCB concentrations (up to about 2 ppm) were detected in the borings installed along the southwestern bank of Willow Brook Pond. These concentrations did not appear to be indicative of a source of PCB contamination.

Area of Former Oil Basin area, within the western section of Willow Brook Pond: This area was investigated to determine if infiltration or seepage from historic operations in the pond area was a potential source. The existing oil-water separator is currently operating in this area. Four soil borings were installed in the vicinity of the area of Former Oil Basin, the small embayment west of the Process Water Facility and south of the lower section of Willow Brook Pond. Two of these borings were installed on top of the bank immediately to the south of the area of Former Oil Basin using a Geoprobe® and advanced to a depth of 20 to 24 feet. The other two were installed by hand to a depth of 2 to 8 feet in the immediate proximity of the existing oil/water separator. PCBs were detected in the soils collected from

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the four soil borings; however, the highest total PCB concentrations were of the order of 1.3 ppm. These concentrations do not appear to be indicative of a source of contamination.

Former Oil-Water Separator, located historically in the area between the two sections of Willow Brook Pond: This area was investigated to determine if infiltration or seepage from historic operations in the Pond area was a potential source. Five soil borings were installed in the vicinity of the Former Oil-Water Separator in between the two sections of Willow Brook Pond to identify potential historic sources of PCB contamination. The soil borings were installed using a Geoprobe® to a depth of approximately 20 feet. Soil samples were collected every 2 feet and screened visually for the presence of oil. Three samples were submitted for analysis from each boring. Elevated total PCB concentrations were observed in the soil samples from this location. The total PCB concentration observed in this area ranged up to 128 ppm (location WT-SB-88) at a depth of 10 to 12 feet. Free oil was also observed in this location. However, the oil was not extracted from the soil matrix for analysis. The highest PCB concentrations were observed at a depth of approximately 8 to 12 feet below ground surface corresponding approximately to the depth of the water and sediment within the pond, and the approximate level of the water table in the area. These concentrations and findings from this area are indicative of a probable source. It should be noted that the contamination might have originated from multiple sources.

Sediment Sampling: In-depth sampling was also performed within the eastern and western water body of Willow Brook Pond, and along Willow Brook in the vicinity of the wetlands area, and in the wetland area within UTC/P&W's property. These samples were collected to develop at-depth profiling information. It should be noted that only surface sediment samples were collected during the initial Phase I investigation. A 5-foot core was used for collection of the sediment and underlying soil samples during Phase II. Generally, one sediment and two soil samples of the underlying soil were selected from each sampling location. Detected total PCB concentrations within the two sections of Willow Brook Pond (east and west) ranged in concentrations up to 258 ppm in the upper 0- to 2-foot interval. The highest concentration was observed in location WT-SD-72 near the pond's effluent point. Approximately 73.5 ppm of total PCBs were detected at a depth interval of 2 to 4 feet in location WT-SD-78, located at the eastern portion of Willow Brook Pond. Significantly lower and/or non-detectable levels were observed at greater depths. PCB concentrations remained at detectable levels at certain locations at depths up to 8 or 12 feet. Total organic carbon (TOC) concentrations up to 162,000 mg/kg were detected in sediment samples within Willow Brook Pond (location WT-SD-75 at a depth of 0 to 2 feet).

The total PCB concentrations detected in Willow Brook in the vicinity of the wetlands area and within the wetlands for surface samples (0 to 6 inches) ranged in concentration from 44 ppm up to 299 ppm (location WT-SD-92). The total PCB concentrations observed in the at-depth samples (1.5 to 2.0 feet) were significantly lower ranging from 2.6 ppm to 5.7 ppm.

Additional investigations were then proposed, focusing on the areas where the highest levels of PCB contamination were identified to further investigate and define the extent of contamination.

Phase III: *Report on PCB Investigation for Willow Brook and Willow Brook Pond*, prepared by LEA, dated April 1999. The purpose of this report was to present the findings of the third phase of PCB investigations in Willow Brook and Willow Brook Pond. During this phase, soil samples were collected from soil borings and monitoring wells installed in the vicinity of Willow Brook Pond. In addition, surface sediment and soil samples to depths of up to 6 feet were collected along the banks of Willow Brook. Soil/sediment samples were collected from the wetland area at Willow Arms and from other adjacent residential properties along the portion of Willow Brook, which lies downstream of Willow

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Brook Pond and to the east of Main Street. Groundwater sampling was also performed in monitoring wells installed at the perimeter of Willow Brook Pond.

Willow Brook Pond Perimeter Sampling: Twelve soil borings and eight monitoring wells were installed in the vicinity of Willow Brook Pond to assess the lateral extent of the contamination. The borings and monitoring wells were installed using a Geoprobe® to a depth of approximately 20 feet. Hand borings to an approximate depth of 12 feet were installed in locations inaccessible by the Geoprobe®. Soil samples were collected every 2 feet and screened visually for the presence of oil. Three samples were submitted for PCB analysis from each boring, including the most contaminated one, based on visual observations, and random ones corresponding approximately to the depth of contamination obtained during the previous investigation. Total PCB concentrations of 50.87 ppm were observed to the east of the eastern water body at Willow Brook Pond, along the reinforced concrete pipe that conveys flow from Willow Brook into Willow Brook Pond. Relatively elevated PCB concentrations up to 14.33 ppm were observed in the area of the Former Oil-Water Separator between the two sections of Willow Brook Pond. This is consistent with previous findings and provides delineation of contamination in this area. Elevated concentrations of semi-volatile organic compounds (SVOCs) and select metals have been observed at some locations. The elevated compounds are consistent and appear to be co-located with the elevated PCB concentrations.

PCBs may have seeped into nearby soils at certain locations, for example at location WT-PZ--140 to the north of the larger water body of Willow Brook Pond (3.82 ppm). However, concentrations detected at depth are generally much lower or below detectable levels. The contamination was confirmed to be primarily contained within Willow Brook Pond.

Wetlands and Stream Bank Sampling: Soil/sediment samples were collected from several abutting residential properties along the segment of Willow Brook between Willow Brook Pond and Main Street. The samples were collected at different elevations along the bank of the brook to assess the lateral extent of contamination. Samples were also collected from the wetlands area at the Willow Arms property and from the adjacent portion of UTC/P&W's property. Surface soil/sediment samples were collected in a total of 28 locations. In seven of these locations, hand auger borings were advanced to approximately 6 feet to assess the vertical extent of contamination. Relatively elevated PCB concentrations (up to 596.2 ppm) were observed within the wetland area. Relatively elevated SVOC and select metals concentrations were also observed within this area, and, as stated before, are consistent and co-located with elevated PCB concentrations. The total PCB concentrations typically decrease to less than 1 ppm at a depth of 4 to 6 feet below grade. Similar concentrations were observed in the wetland area within UTC/P&W property. Total PCB concentrations up to 21.77 ppm were detected from sediment within Willow Brook in the off-site properties (downstream of the wetland area). The PCB concentrations observed drop substantially at higher elevations along the bank of Willow Brook, indicating that the contamination is confined within the brook and the wetland. PCB concentrations decrease to less than 1 ppm prior to Main Street.

Groundwater Sampling: Groundwater samples were collected by LEA personnel from the installed monitoring wells on December 4, 1998. Samples were collected using a peristaltic pump and dedicated polyethylene tubing. Of the eight monitoring wells installed, PCBs were only detected at two locations. PCBs were detected in groundwater from monitoring wells WT-PZ-136 [8.5 parts per billion (ppb)] and WT-PZ-139 (0.73 ppb). These wells are in the vicinity of locations where the highest PCB concentrations in soil have been detected.

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Surface Water Sampling: Surface water samples were collected from two locations at Willow Brook Pond (at the pumps from the larger water body prior to entering the facility for non-contact cooling water use and at the dam) and from Willow Brook (downstream of Willow Brook Pond at the intersection with Main Street). No PCBs were detected in any of the surface water samples collected.

1.4 Nature and Extent of Contamination

1.4.1 Soil and Sediment

Overall and with consideration of the data collected to date, PCB concentrations are generally distributed in the brook and pond sediments gradually decreasing in concentration in the downgradient direction. This decrease trends from > 100 ppm in the pond and wetland areas to a concentration of < 1 ppm at Main Street. PCBs were also found in the soils between the two ponds, where the former oil/water separator was located. The vertical extent of PCB impacts has been defined by the sampling conducted, generally achieving non-detect or concentrations < 1 ppm at depths ranging from 4 to 6 feet below grade in the wetland area and 14 to 16 feet below grade in the soil between the upper and lower Willow Brook Pond (in the vicinity of the former oil-water separator). Soil samples collected along and up the banks of the brook and ponds define the horizontal limits of PCB to non-detect or concentrations of < 1 ppm. Figures 1-2 and 1-3 depict the extent of PCB impact in the Willow Brook and Willow Brook Pond area. Within the pond and brook the PCBs are commingled with SVOCs and select metals.

1.4.2 Groundwater

Groundwater samples collected during the remedial investigation identified only two locations where PCB concentrations were above detection limits (WT-PZ-136 at 8.5 ppb and WT-PZ-139 at 0.73 ppb). Well WT-PZ-136 is located in the immediate vicinity of the former oil/water separator and locations of high PCB content in soil. Well WT-PZ-139 is adjacent to an area of elevated PCB in soils. It is expected that removal of soil and source material in these areas will address PCB in groundwater. As these areas and the previously sampled monitoring wells will be removed during RA, post-excavation groundwater monitoring will be conducted to confirm no impacts to groundwater remain following excavation. This monitoring will be conducted through the installation of new monitoring wells in the area.

1.4.3 Surface Water

Surface water sampling from Willow Brook and Willow Brook Pond was performed on February 6, 1998. Samples were collected from Willow Brook Pond at the pumps pumping from the larger water body and dam and from Willow Brook downstream of Willow Brook Pond at Main Street. No PCBs were detected in any of the surface water samples collected.

2.0 STATEMENT OF WORK

The remediation plan for Willow Brook and Willow Brook Pond project as defined in Section 1.0, involves the excavation and offsite disposal of soil and sediment containing total PCB concentrations in excess of 25 ppm with the following exceptions. The exceptions to this approach is the wetland downgradient of the dam where excavation of soil at concentrations greater than the Residential Direct Exposure Criteria for PCBs will be performed and the area backfilled and planted to restore the wetland, and the footprint of the process water facility where soil will be remediated to meet the Residential Direct Exposure Criteria for PCBs for soils within 4-feet of the final grade, the Commercial/Industrial Direct Exposure Criteria for PCBs for soils located in inaccessible locations and the GB Pollutant Mobility Criteria for soils above the seasonal high water table, prior to the placement of backfill.

Following excavation and removal of the impacted soil and sediment within Willow Brook and Willow Brook Pond, a cap consisting of an organic rich soil layer, a gravel layer and a stone layer will be placed within the limits of Willow Brook and Willow Brook Pond. The dam structure between Willow Brook Pond and the open channel section of Willow Brook will remain intact. The area will be restored to much the same configuration as exists today with two ponds (upper and lower Willow Brook Ponds) and an open channel (Willow Brook) from the downstream end of the pond to the cross culvert at Main Street. The existing wetland downstream of the pond will also be restored. Details regarding site restoration and capping are further discussed in Section 2.3.

As noted previously, soil and sediment within Willow Brook and Willow Brook Pond are also impacted by SVOCs, metals, and petroleum hydrocarbons. During the removal of PCB contaminated soil and sediment, a large percentage of the soils and sediment impacted by these constituents will also be removed. Remediation of other constituents of concern found in the remediation areas will be completed in accordance with the Remediation Standard Regulation (RSR), 22a-133k-1 through 3 of the Regulations of Connecticut State Agencies (RCSA). The remediation goals for the ancillary constituents are presented in tabular format in Appendix A and B to 22a-133k-2, more specifically the Residential and Commercial/Industrial criteria in Appendix A, the GB Mobility Criteria in Appendix B and/or alternative criteria in accordance with those specific provisions. In any event, any remaining contamination will be capped in accordance with the variance provisions in the RSR as noted previously. Following remediation, UTC/P&W will implement two institutional controls to ensure the long-term protectiveness of the proposed remedy. The institutional controls consist of 1) an Environmental Land Use Restriction to ensure the affected area will not be used for residential purposes and to prohibit excavation and 2) installation of a fence around the entire project area to preclude access to Willow Brook and Willow Brook Pond.

The proposed 25 ppm total PCBs action level within Willow Brook and Willow Brook Pond assumes future use of the remediation area as an open pond to be flanked by green space. However, as noted above, a perimeter fence will be installed to preclude free access to the remediated area. In the event that redevelopment of this area involves a bike path or roadway, the area directly beneath those uses will be remediated to a total PCB concentration of less than the Residential Direct Exposure Criteria. A release of the aforementioned Environmental Land Use Restriction by the Commissioner of the Department of Environmental Protection would be necessary before any redevelopment activities are initiated. Such release would necessitate the preparation of a detailed remediation and restoration plan, which would be consistent with the future proposed use of the subject area or part thereof. Furthermore, should redevelopment of the area necessitate remediation to less than the Residential Direct Exposure Criteria, appropriate barriers (i.e. fencing or railings) would be installed between the capped areas and the areas remediated to less than the Residential Direct Exposure Criteria.

2.1 General

This section details the work to be completed during the project. The section begins with a discussion of pre-construction activities including the application for necessary Federal, State of Connecticut and Town of East Hartford permits to complete the work, and the design of the project. This is followed by a discussion of the construction activities including site preparation, the demolition and removal of existing structures, contaminated soil and sediment excavation and offsite disposal, wetlands restoration, site restoration activities, implementation of institutional controls, and record keeping and reporting. The last part of this section details post-construction activities. This includes a discussion on the preparation of a post-remediation report detailing the remediation activities and a post-remediation groundwater monitoring program.

2.2 Pre-Construction Activities

This section contains a description of those activities that will be completed prior to the initiation of PCB removal activities at the site. The pre-construction activities are presented in three general categories: project permits, engineering design, and health and safety plan.

2.2.1 Project Permits and Approvals

Prior to the initiation of construction activities and the completion of design activities, it will be necessary to obtain permits from a variety of regulatory agencies maintaining jurisdiction over the work. The agencies include the Army Corps of Engineers, the State of Connecticut Department of Environmental Protection, and the Town of East Hartford Inland Wetlands, and Planning and Zoning Commissions.

US Army Corps of Engineers

The work of this project involves the excavation of nearly 12,500 cubic yards of contaminated soil and sediment from within Willow Brook and Willow Brook Pond. The majority of the excavation activities occur within the two ponds, within the wetlands west of the ponds, or immediately adjacent to these areas. The construction activities will result in the disturbance of greater than 1-acre of wetlands within and immediately abutting the work. A permit from the Army Corps of Engineers is necessary prior to performing a construction activity that impact greater than 1-acre of inland wetlands. In consideration of the fact that the project will result in the disturbance of greater than 1-acre of inland wetlands, the permit from the Army Corps of Engineers will be sought through the individual permit process. The permit application was filed on February 14, 2001 and has been issued. As part of this permit application, a public notice was issued. In response to the notice, the Army Corps of Engineers did not receive any substantive comments.

Connecticut Department of Environmental Protection

Prior to initiation of the construction activities, it will also be necessary to obtain a permit from the CTDEP Inland Water Resources Division. This permit will address the need to obtain a water quality certification for the excavation/placement of fill within the flood plain and wetlands pursuant to Section 401 of the Clean Water Act. The permit application was filed on February 14, 2001 and has been issued. Comments from the DEP on the application have been received and addressed in a revised submission. As part of this permit application, a public notice was issued. In response to the notice, the CTDEP Inland Water Resources Division did not receive any substantive comments.

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The application to the IWRD was prepared and submitted on forms approved by the DEP and included: a permit application transmittal form; the permit application for programs administered by the IWRD; the technical documentation form; an executive summary; a USGS site location map; a listing of all adjacent property owners; a soil scientists report; an engineering/hydrogeologic report; flood management consistency worksheets; an environmental report; an alternatives assessment; a flood contingency plan; and plans and drawings detailing the work.

In addition to the above pre-construction permit, it was also necessary to register for the General Permit for the Discharge of Storm Water and Dewatering Wastewaters Associated With Construction Activities and the General Permit for the Discharge of Groundwater Remediation Wastewater. In addition, based on flows anticipated to be generated during construction dewatering and limitations on quantity of water to be discharged to the Town of East Hartford wastewater treatment facility, a temporary authorization has been granted to allow for the discharge of treated groundwater to the Connecticut River. The CTDEP Bureau of Water Management has issued both General Permits as well as the Temporary Authorization. In addition, a Storm Water Pollution Control Plan (a requirement of the storm water general permit) has also been prepared.

In addition to the above permits, it will also be necessary to secure an approval for the use of an engineered control to remediate soil and sediment within the project area. The engineered control consists of the pond bottom/sediment, stream channel, and composite caps to be installed following excavation activities within the project area. The request was submitted to the CTDEP on January 5, 2001 in accordance with Section 22a-133k-2(f)(2)(B) of the Regulations of Connecticut State Agencies. The request was a detailed report and plan which was prepared to satisfy the requirements of the above referenced regulatory section and to document that the cost of excavation and offsite disposal of the polluted soil at the site is significantly greater than the cost of installing and maintaining an engineered control and conducting groundwater monitoring. The request further documented that the significantly greater cost outweighs the risk to human health and the environment if the engineered control fails to prevent the mobilization of, or human exposure to the remaining polluted soils. No substantive comments were received and the approval for the use of an engineered control was granted.

Town of East Hartford

Prior to the initiation of construction activities, it will be necessary to obtain three permits from the Town of East Hartford. These permits will be issued by the Inland Wetlands, and Planning and Zoning Commissions. The Inland Wetlands Commission permit will be necessary prior to the performance of construction activities within wetlands or within specified distances from a wetland. The Inland Wetlands Commission issued an approval for the project following a public hearing on the application on April 24, 2001.

The Planning and Zoning Commission permits will be in the form of a Major Flood Hazard Permit and a Soil Erosion and Sedimentation Control Permit. The Major Flood Hazard Permit will be necessary prior to performing construction activities within a flood hazard area of the Town of East Hartford. This application was submitted to the Town of East Hartford on May 7, 2001 and was approved on June 27, 2001. The Soil Erosion and Sedimentation Control Permit must be obtained prior to initiating a construction project, which includes disruption to greater than ½ acre of land in the Town of East Hartford. This application was submitted on May 29, 2001 and was approved on June 27, 2001. It should be noted, an Excavation Permit will not be necessary, as a special exception has been sought as the construction activities are being undertaken as part of a remediation project.

2.2.2 Engineering and Design

Prior to the implementation of the construction activities at the site, design drawings and technical specifications necessary to support permitting activities will be prepared to depict each phase of the project. The construction drawings will be used in support of applications to obtain necessary permits as well as to direct the efforts during the construction activities. The technical specifications will be of adequate detail to ensure that each phase of construction is performed in accordance with the terms and conditions of any permits obtained prior to the initiation of construction, this Remedial Action Plan, and other applicable local, state and/or federal requirements. The project is being performed as a design-build effort. As such, detailed design plans and specifications beyond that which are necessary to support the permitting efforts and to establish the performance criteria for the remediation project, are not necessary. The drawings and figures contained herein represent the current status of engineering design for the project. Additional engineering design is not anticipated, other than the anticipated minor field alterations necessitated by changed conditions.

2.2.3 Health and Safety Plan

A Health and Safety Plan (HASP) will be prepared prior to the initiation of construction activities. The HASP will detail safety organization, procedures, and personal protective equipment that are based on an analysis of potential site-specific hazards. The HASP, will meet the requirements of 29 CFR 1910 and 29 CFR 1926 (which includes 29 CFR 1910.120 and 29 CFR 1926.65). The HASP will include, but will not be limited to, the following components:

- Identification of key personnel - All on-site personnel involved with the construction activities at the site will be required to maintain Occupational Safety and Health Administration (OSHA) 40-hour Hazardous Waste Training (29 CFR 1910.120 and 29 CFR 1926.65) and the corresponding 8-hour refresher course update
- Training – A description of health and safety training requirements for supervisory and on-site personnel will be presented. Training requirements will include attending an initial site orientation prior to performing on-site activities
- Medical Surveillance – A description of appropriate medical examinations required for supervisory and on-site personnel.
- Site Hazards – A description of chemical, physical, and climatological hazards associated with the project.
- Work Zones – A description of the work zones that will be established during construction activities.
- Personnel Safety Equipment and Protective Clothing – A description of personnel protective equipment and protective clothing to be used and available on site.
- Equipment Cleaning – The methods and procedures for decontamination of personnel, materials, and equipment will be described.
- Confined Space Entry – A listing of confined spaces and description of procedures for confined space entry in accordance with Permit Required Confined Space Entry (29 CFR 1910.146).
- Excavation Safety – A description of excavation and trenching safety procedures as specified in 29 CFR 1926 Subpart P.
- Standard Operating Procedures and Safety Programs as required by applicable portions of 29 CFR 1910 and 29 CFR 1926.

2.3 Construction Activities

The proposed construction activities involve:

- The excavation and installation of a temporary lined by-pass channel with inlet and outlet structures;
- The demolition of the existing process water facility building structures and the offsite disposal of construction demolition debris;
- The removal and offsite disposal of the former oil/water separator located between upper and lower Willow Brook Pond and the excavation and complete removal of the structure with offsite disposal of impacted soil and concrete and the placement of an engineered control to achieve compliance with the variance provisions in the RSR;
- The excavation and offsite disposal of approximately 8,500 cubic yards of soil and sediment containing total PCBs at concentrations greater than 25 ppm from within and immediately surrounding Willow Brook and Willow Brook Pond;
- The excavation and offsite disposal of approximately 1,500 cubic yards of soil and sediment containing PCBs at concentrations between 1 and 25 ppm from within and immediately surrounding the wetland area located north of Willow Brook;
- The excavation and offsite disposal of approximately 2,500 cubic yards of soil and sediment from within the open channel of Willow Brook to allow for the installation of the geotextile, soil, and stone cap within the stream channel;
- The placement of a geotextile, soil and stone cap (engineered control) over the entirety of the excavated area (with the exception of an approximately 1-acre wetland described below and the footprint of the process water facility) to isolate sediment containing less than 25 ppm total PCBs commingled with semi-volatile organic compounds, petroleum hydrocarbons, and select metals to achieve compliance with the variance provisions in the RSR;
- The restoration of an approximately 1-acre wetland located downstream of the Willow Brook Pond Dam; and
- The implementation of two institutional controls consisting of 1) an Environmental Land Use Restriction to ensure the affected area will not be used for residential purposes and to prohibit excavation; and 2) installation of a fence around the entire area to preclude access to Willow Brook and Willow Brook Pond.

The following parts of this section describe in general each of the anticipated construction activities necessary to complete the remediation.

2.3.1 Site Preparation

Drawing 2-1 presents the general site preparation details associated with this project. The following is a general description of anticipated site preparation activities.

Erosion Control

Appropriate soil erosion and sedimentation control methods (e.g., silt fence, straw bale dikes, absorbent booms, etc. as depicted in Figure 2-1) will be installed to mitigate the transport of suspended solids or sediments downstream. A soil erosion and sediment control plan is a component of applications for local, state and federal permits. Due to the magnitude of excavation to accomplish the removal of contaminated soil and sediment, excavation activities may be suspended during periods of heavy precipitation.

Clearing and Grubbing

The area in the immediate vicinity of Willow Brook and Willow Brook Pond is covered with a variety of vegetation, including the wetland areas (see Drawing 2-1). Vegetation ranges from mowed grass to mature trees. To gain access to perform the planned excavation activities, clearing and grubbing will be required. Cutting, processing, and appropriate disposal of heavy vegetation will be a component of the project. It is anticipated that stumps from trees located in areas known or suspected to be impacted by PCBs or other constituents will be disposed of at an offsite facility as PCB remediation waste. The remainder of the woody debris will be shipped offsite for volume reduction and/or disposal as a solid waste in accordance with the State of Connecticut Solid Waste Management Regulations.

Decontamination Facilities

Contractor equipment that has been in contact with contaminated soil and sediment will require decontamination prior performing work in an uncontaminated area or demobilization from the site. A decontamination pad or pads will be strategically located at the site adjacent to excavations and vehicle loading areas. Potential locations for decontamination facilities are shown on Drawing 2-1. The decontamination pad or pads will generally be constructed of a wood frame or similar materials, lined with heavy plastic, and include a layer of open stone. Equipment that has come into contact with contaminated soil and sediment will be cleaned with a pressure washer, scrub brushes and organic solvent using a double wash/rinse process in accordance with Subpart S of 40 CFR Part 761 over the decontamination pad.

Durable field sampling equipment (e.g., stainless steel trowels, plastic scoops, shovels, etc.) used to implement the Field Sampling and Analysis Plan will be decontaminated prior to each sample location to mitigate the potential for cross-contamination of samples collected for laboratory analysis. Decontamination will be performed in accordance with Standard Operating Procedures (SOP) provided as Appendix B and in accordance with 40 CFR Part 761.79(b).

Wash water and detergents used in the decontamination process will be disposed of following pretreatment through a mobile water treatment system (described in more detail later in this document) to the sanitary sewer in accordance with the terms and conditions of the CTDEP General Permit for the Discharge of Groundwater Remediation Wastewater or to the Connecticut River following treatment through the P&W Colt Street Industrial Wastewater Treatment Facility in accordance with the terms and conditions of the Temporary Authorization granted by the CTDEP. The terms and conditions of the General Permit require removal of PCBs to a concentration of 1 µg/L and the terms and conditions of the Temporary Authorization require the removal of PCBs to a concentration of 0.5 µg/L prior to discharge to the Colt Street facility.

Site Security

Limiting access to the site during construction will be accomplished thorough the use of both existing and permanent fencing (refer to Drawing 2-1 and Figure 2-2), along the north side of Willow Brook and Willow Brook Pond, and temporary construction fencing to be installed along Willow Street. The fencing will be supplemented by the use of security personnel to ensure that unauthorized persons do not access the construction site during remediation activities.

2.3.2 Demolition and Removal of Existing Structures

As part of the remedial activities, select buildings and other structures will be demolished (see Drawing 1-1). A list and description of the primary structures to be demolished and removed are as follows:

- Five buildings and components associated with the process water facility;
- Miscellaneous utilities such as pipes and conduits;
- Metal sheeting and shoring;
- Miscellaneous concrete structures such as duct banks and abutments; and
- The former underground oil/water separator located between the upper and lower sections of Willow Brook Pond.

Area Preparation

Prior to demolition, a complete survey of the structures and their components will be performed. The survey is necessary to determine decommissioning, demolition, and disposal requirements. UTC/P&W will be responsible for shutdown and removal of components they intend to reuse from the process water facility.

Process Water Buildings

Demolition of the process water facilities will extend to a depth necessary to achieve the project objectives of remediating PCB contaminated soil to meet the Residential Direct Exposure Criteria for soils within 4-feet of the final grade, the Commercial/Industrial Direct Exposure Criteria for soils located in inaccessible locations and the GB Pollutant Mobility Criteria for soils above the seasonal high water table. Other related structures, such as pilings, erosion structures, etc., will also be demolished and removed to a depth necessary to achieve the project objectives. Sheeting, shoring, pipes and utilities connected to or otherwise associated with these buildings will be abandoned or removed during the demolition activities or during the soil and sediment removal phase of the project.

Porous structures and non-porous utilities and related structures (sheeting, shoring, etc.) decontaminated or otherwise designated for in place abandonment will be sampled to confirm compliance in accordance with the Field Sampling and Analysis Plan presented in Section 4.0. All confirmatory characterization samples will be analyzed in accordance with the Quality Assurance Project Plan in Section 5.0.

Porous structures designated for in-place abandonment will be analytically assessed and decontaminated if necessary to achieve 25 ppm PCBs for abandonment in areas with land use restrictions and 1 ppm PCBs in other areas.

Non-porous utilities and associated structures (sheeting, shoring, etc.) designated for in-place abandonment will be analytically assessed and decontaminated if necessary to achieve a $100 \mu\text{g}/100 \text{ cm}^2$ for abandonment in place in capped areas and $10 \mu\text{g}/100 \text{ cm}^2$ in uncapped areas. Utilities located within an area of soil remediation shall be excavated and disposed of as bulk remediation waste.

A Civil War marker/gravestone is located to the east of the main water processing building. This feature shall be protected during all aspects of the work.

Former Oil/Water Separator

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A buried oil/water separator is located between the upper and lower sections of Willow Brook Pond. This structure and surrounding soils are contaminated with PCBs. The oil/water separator, its contents, and the soil containing greater than 25 ppm PCBs surrounding the structure will be completely removed and disposed of at an offsite location during the project. If a light-non-aqueous phase liquid (LNAPL) is identified during excavation, the remediation will proceed until the LNAPL is removed in accordance with Section 22a-449(d)-106(f) of the Regulations of Connecticut State Agencies. However, it is anticipated that the presence of LNAPL is coincident with soils containing greater than 25 ppm PCBs and the removal of the LNAPL would be completed during excavation of those soils. Prior to removal of the structure, the oil/water separator will be exposed and any liquids will be removed, characterized, and disposed of at an offsite location.

Available analytical data are sufficient to delineate the three-dimensional extent of soil impacted by PCBs in the vicinity of the oil/water separator. However, the data are not adequate for the purposes of establishing the lateral limits of the composite cap to be installed in this area to address soils impacted by other constituents. As a result, prior to implementing the remediation in this area, soil borings will be advanced to a depth of 15 feet using the Geoprobe®. Soil samples will be collected from each Geoprobe® soil boring and analyzed for PCBs and constituents other than PCBs. The intent of the sampling will be to delineate the three-dimensional extent of other soils requiring remediation for other constituents pursuant to the RSRs. It is anticipated that soil samples will be analyzed for mass and SPLP metals (RCRA 8 plus copper, nickel and zinc), cyanide, VOCs, SVOCs, and TPH. The location of each soil boring is discussed in Section 4.0.

Demolition Debris Management

Further evaluation of the affected structures and components will be performed to determine disposal requirements prior to demolition. Appropriate samples will be collected and submitted for laboratory analysis to characterize the waste for disposal. Any demolition debris characterized as bulk PCB remediation waste shall be disposed of at a chemical waste landfill approved under 40 CFR 761.75. The sampling procedures and protocols are further discussed in Section 4.0, Field Sampling and Analysis Plan. It is anticipated that all material removed in the demolition process will be disposed of off site. An expected waste stream summary is presented in Section 4.0.

Soil Sampling and Analysis

Sampling and analysis of certain soils below and adjacent to the subject buildings and structures will be required to confirm horizontal and vertical limits, disposal and handling requirements. Soil confirmatory samples will be collected and analyzed in accordance with the Field Sampling and Analysis Plan presented in Section 4.0. The excavated and staged soil will be sampled for disposal characterization. The soil disposal characterization samples will also be collected in accordance with the Field Sampling and Analysis Plan. All confirmatory and disposal characterization samples will be analyzed in accordance with the Quality Assurance Project Plan in Section 5.0.

2.3.3 Contaminated Soil and Sediment Excavation and Offsite Disposal

This section presents a summary description of the planned soil and sediment excavation and offsite disposal activities. As noted, it is anticipated that approximately 12,500 cubic yards of contaminated soil and sediment will be excavated and disposed of at an offsite location during the project. The proposed by-pass channel was incorporated into this project primarily to facilitate in-situ dewatering and to mitigate potential logistical complications associated with other water handling options. Based on the available

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historic stream channel bathymetry and utility invert data, the by-pass channel is expected to effectively relieve the groundwater table to an elevation below 21.00 in the pond areas. A field determination will be made based on the percent solids observed in the in-situ material, to excavate the material and direct-load the haul vehicles for off-site disposal, or to excavate the material and stage it in a temporary staging area for further gravity dewatering. The staged material would again be evaluated after a 24-hour period to assess the percent solids. If the percent solids are unacceptable for over-the-road transport, lime will be added to the material to further stabilize it and to achieve compliance with shipping requirements.

If it is determined that material staging in stockpiles is necessary to facilitate the offsite disposal of the contaminated soil and sediment, a material staging and stockpile area will be constructed. The material staging and stockpile area construction and operation is discussed in greater detail below.

Contaminated soil and sediment will be characterized for disposal based on the "as-found" concentration of PCBs. Additional analysis will be performed on stockpile grab samples as needed to satisfy the disposal vendor. The waste will be disposed of based upon the more restrictive analytical data regardless of the as-found concentrations (e.g. if in-situ characterization documents < 50 ppm PCBs and the stockpile data suggests > 50 ppm, the waste disposal profile used for this particular load would be based on the stockpile data). Stockpile analytical data would not be used to reduce any disposal restrictions on the material.

Stream Flow During Construction

The construction project involves the excavation of submerged sediments from within Willow Brook and Willow Brook Pond. Remediation will begin at the upstream pond and progress downstream. To accomplish the excavation, it will be necessary to temporarily redirect flow within Willow Brook.

During construction, all flow entering the PCB remediation work area from the upstream conduit of Willow Brook will be bypassed by the construction of a channel capable of conveying a 100 year flood as defined by the Flood Insurance Study prepared for the Town of East Hartford in January of 1979. The bypass channel will be constructed on the south side of the Willow Brook and Willow Brook Ponds as depicted in Drawing 2-2 and as detailed in Figure 2-3 through 2-5. Provisions will be made to direct local drainage that enters the work area directly from storm sewers on United Technologies Corporation, Pratt & Whitney property on the south side of the work area into the bypass channel. Storm water discharges from municipal and privately owned storm sewers that enter the work area from the north will either be conveyed or pumped around active work areas. During a 500-year flood, the hydraulic gradient above the work area would be higher than the conduit, and the backwater would cause some catch basins to be surcharged above the surface elevation of the inlets upstream of the conduit outlet. Provision has been made to seal the catch basins within the temporary staging and stockpile areas upgradient of the conduit outlet and to block surface flow from entering either the work area or the storage areas.

Dewatering

In addition to water diversion, it is also likely that construction dewatering will be necessary to facilitate the removal of soil and sediment containing greater than 25 ppm total PCBs. Conventional sump or well-point techniques will be employed to allow for spot dewatering of excavation areas. All dewatering wastewater will be containerized, treated as necessary, sampled, then discharged to either the Town of East Hartford Water Pollution Control Facility or back into The Connecticut River. Discharge to the Town of East Hartford Water Pollution Control Facility will be accomplished through a sanitary sewer and will be in accordance with a general permit, issued by the DEP, for the Discharge of Groundwater

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Remediation Wastewater to a Sanitary Sewer. Discharge to the Connecticut River will be performed in accordance with the Temporary Authorization to be issued by the DEP. The temporary authorization will require the removal of PCBs to a concentration of less than or equal to 0.5 µg/L. All related monitoring and record keeping shall be implemented as mandated by either the general permit or the Temporary Authorization. A copy of the general permit and the Temporary Authorization is provided as Appendix C.

Excavation Methods

The excavation program will advance from upstream to downstream within Willow Brook Pond and the Willow Brook streambed. The approximate horizontal limits of the soil and sediment removal activities are presented on Drawing 2-3. Based on the prior investigations, it is anticipated that an average of 2 to 3 feet of sediment will be removed from the pond and brook, respectively and up to 4 feet within the wetland area. Soil from depths of up to 16 feet will be excavated in the vicinity of the former oil/water separator. Confirmatory soil samples collected during the remediation will provide the final horizontal and vertical limits of excavation. The soil and sediment excavation will be accomplished through the use of track-mounted excavators, bulldozers, and loaders. It likely that some or all of the equipment will be of a low ground pressure configuration to allow operation within the pond and stream channel.

Once the target soils and sediment have been removed and verified, the excavation will continue in the next remediation area and the placement of the geotextile, soil and stone cap (See Section 2.3.4) can proceed. Should the confirmatory samples indicate that the 25 ppm total PCB limit has not been achieved within the pond and brook or the Residential Direct Exposure Criteria for PCBs within the wetland area, additional excavation will be performed. Excavation will continue until all soil and sediment containing PCBs at concentrations in excess of 25 ppm within the pond and brook and the Residential Direct Exposure Criteria for PCBs within the wetland are removed.

Soil/Sediment/Concrete and Non-Porous Material Sampling And Analysis

Sampling and analysis of certain soils/sediments/concrete and non-porous material will be required to confirm horizontal and vertical limits, disposal and handling requirements. Soil/sediment/concrete and non-porous material confirmatory samples will be collected in accordance with the Field Sampling and Analysis Plan presented in Section 4.0. The excavated and staged soil/sediment/concrete and non-porous material will be sampled for disposal characterization. These disposal characterization samples will also be collected in accordance with the Field Sampling and Analysis Plan. All confirmatory and disposal characterization samples will be analyzed in accordance with the Quality Assurance Project Plan in Section 5.0.

Soil/Sediment/Concrete and Non-Porous Material Staging

During the soil and sediment removal activities the excavated soil/sediment/concrete and miscellaneous non-porous material may need to be temporarily relocated into staging areas adjacent to the excavation area for gravity dewatering and lime stabilization as detailed above. The staging areas will consist of a perimeter berm and will be lined with polyethylene and pavement to contain all soils and liquids. Soil/sediment/concrete and miscellaneous non-porous material placed within the staging areas shall be covered with a low permeability sheet to limit exposure to precipitation. All water within the staging areas will be collected in a pre-formed sump located at an intentionally defined low spot within the staging area(s). The collected water will be pumped to a settling tank, as necessary, within which solids will be separated. Water will be decanted from the settling tank, treated in an onsite water treatment

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system then discharged to the Town of East Hartford Water Pollution Control Facility or treated at the P&W Industrial Wastewater Treatment Facility and discharged to the Connecticut River. Sampling, as necessary to comply with the terms and conditions of the General Permit or the Temporary Authorization will be performed. Prior to initiating the discharge to the sanitary sewer, the treated water will be sampled to ensure that the PCB concentration is less than 1 µg/L and all other constituents comply with the terms and conditions of the general permit. Prior to initiating the discharge to the Connecticut River, the treated water will be sampled to ensure that the PCB concentration is less than 0.5 µg/L and all other constituents comply with the terms and conditions of the Temporary Authorization.

Stabilization

The excavated soil and sediment shall be staged for dewatering by gravity within a staging area in order to meet applicable requirements for disposal (i.e., no free liquids). It is anticipated that the soil and sediment will be further stabilized utilizing up to six percent lime by weight, only if necessary. Lime will be evenly incorporated into the excavated soil and sediment via mechanical mixing. This stabilization process is intended to facilitate the legal shipping of the contaminated material over-the-road to a permitted offsite disposal facility.

Off-Site Disposal

It is anticipated that all soil and sediment excavated as part of this project will be shipped to an offsite facility for disposal. The offsite disposal includes handling, storing, containerizing, transporting (including providing and preparing manifests, bills of lading, etc.) and disposing of excavated soil and sediment. The excavated soil and sediment will be transported via a licensed waste hauler to a permitted chemical or solid waste disposal facility dependant on the waste characterization. The estimated in-place volume of soil and sediment requiring offsite disposal is 12,500 cubic yards. A Table summarizing the off site disposal designation for the various waste streams anticipated follows.

Wastestream Description	Characterization Procedures	Disposal Designation
Soil/Sediment/Concrete PCB>50ppm	In-situ soil sampling	RCRA/TSCA permitted Facility
Soil/Sediment/Concrete PCB<50 ppm	In-situ soil sampling and stockpile characterization for disposal vendor	Subtitle D Landfill
Debris (non-porous materials) in an area of soil/sediment w/PCB >50 ppm	Assumed to be > 50 ppm PCB	RCRA/TSCA permitted facility
Debris (non-porous materials) in an area of soil/sediment w/PCB <50 ppm	In-situ soil sampling and disturbed debris sampling when in-situ is not practical	Subtitle D Landfill
Miscellaneous PPE, plastic sheeting, disposable sampling equipment, etc.	Assumed to be >50 ppm PCB	RCRA/TSCA permitted facility

Dust-Control

Included as Appendix D is a project-specific Dust Control Plan. This plan establishes the activities that will be performed to minimize the potential exposure to unacceptable levels of airborne contaminants during the work.

2.3.4 Pond/Stream Channel Cap, Engineered Control, Wetland Restoration

Following the excavation and demolition activities, Willow Brook and Willow Brook Pond will be restored. The planned restoration activities are described in detail below and depicted on Drawings 2-4 and 2-5 with related details and sections presented in Figures 2-6 through 2-8. The site restoration involves the installation of 3 types of caps/engineered controls over soil and sediments remaining following excavation and removal of those containing total PCBs at concentrations greater than 25 ppm. The cap details were derived based on the anticipated stream flow velocities and considered the ultimate use of the area as a combined wetland, pond, and stream channel. The base of each cap consists of a non-woven geotextile, a 9-inch layer of organic rich soil, and a non-woven geotextile. This layer is referred to below as an organic-rich layer. This organic-rich layer is included as a contingency to mitigate any potential for PCBs to migrate vertically upward through the proposed soil and rock cap. The caps are described below and are depicted on Figures 2-6 through 2-8.

- Within Willow Brook Pond, a 36-inch soil and stone cap is proposed (refer to Drawing 2-4 and Figure 2-6). The cap will consist of a 9-inch organic rich layer, 21 inches of process gravel, and a 6-inch layer of 4-inch stone. As the flow velocity in Willow Brook Pond is extremely low and is controlled by the dam at the outlet to the pond, the stone lining will provide adequate protection against erosion.
- Within Willow Brook (downstream of the dam), a 36-inch soil and stone cap is proposed (refer to Drawing 2-4 and Figure 2-7). The cap will consist of a 9-inch organic rich layer, a 15-inch layer of modified riprap and a 12-inch layer of cobbles, gravel and coarse sand. The 15-inch layer of modified riprap extends the width of the channel bottom and transitions into a 24-inch layer of intermediate riprap on the side slopes of the channel banks. The 24-inch layer of modified riprap extends up the channel banks to the elevation of the 10 year flood. The riprap channel lining has been designed to withstand the erosive forces anticipated in the stream channel following completion of the construction project.
- The area of the underground oil/water separator will be provided with a composite cap (refer to Drawing 2-4 and Figure 2-8). The composite cap will consist of a 40-mil flexible membrane liner, a geotextile drainage layer, 30-inches of granular backfill, and a 6-inch loam and seed layer.
- In addition to the above, the wetland north of Willow Brook will be restored by providing a soil and wetland sediment cap consisting of 24 inches of granular fill, and 12-inches of wetland soil. The wetland will be planted with native wetland plants (refer to Drawing 2-4 and Figure 2-9).

In response to a request by the Department of Environmental Protection (DEP) staff, the Willow Brook stream channel will be slightly modified between the dam that impounds Willow Brook Pond and Main Street to reduce the slope of the banks to control potential erosion and to modify the character of the channel bottom to create a low flow channel with pools and eddies. The limits of these improvements are shown on Drawing 2-5.

2.3.5 Site Restoration

Following the completion of the excavation and offsite disposal of contaminated soil and sediment, all areas disturbed by construction will be restored. The restoration of the waterway and wetland were described in the previous section (2.3.4). It is anticipated that restoration activities for area outside the waterway and wetland will consist of the installation of paved parking areas or grassed areas. Planned final site restoration is presented in Drawing 2-4.

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The future site use options may consist of the following:

- Additional automobile and/or truck parking; and
- Relocation/rerouting of Willow Street to the northern portion of the property as indicated on Figure 2-10.

Following restoration activities, UTC/P&W will implement two institutional controls to ensure the long-term protectiveness of the proposed remedy. The institutional controls consist of 1) an Environmental Land Use Restriction to ensure the affected area will not be used for residential purposes and to prohibit excavation and 2) installation of a fence around the entire area to preclude access to Willow Brook and Willow Brook Pond (refer to Figure 2-5 and Drawing 2-4).

In the event that redevelopment of this area involves a bike path or roadway, the area directly beneath those uses will be remediated to a total PCB concentration of less than the Residential Direct Exposure Criteria. A release of the Environmental Land Use Restriction by the Commissioner of the Department of Environmental Protection would be necessary before any redevelopment activities are initiated. Such release would necessitate the preparation of a detailed remediation and restoration plan, which would be consistent with the future proposed use of the subject area or part thereof. Furthermore, appropriate barriers (i.e. fencing or railings) would be installed between the capped areas and the areas remediated to a concentration less than the Residential Direct Exposure Criteria.

2.3.6 Record Keeping and Reporting

The following records will be maintained during construction to document the remedial activities:

1. The delineation of the final horizontal and vertical limits of the soil and sediment removal activities;
2. A photographic record of construction progress;
3. Records of all quality assurance/quality control (QA/QC) testing performed;
4. A record of all field screening and confirmatory sampling and analytical results, including sampling methods, locations and depths, frequency, and analytical results;
5. Results of all waste disposal characterization samples of excavated materials;
6. Results of all samples of treated effluent from the temporary on-site wastewater treatment system;
7. A record of all daily activities; quantities of materials removed, generated, used, and disposed of; and document manpower, material, and equipment used;
8. A record of all materials and equipment delivered to the site; and
9. Copies of all hazardous waste manifests, non-hazardous waste bills of lading, and certificates of disposal for wastes generated during the project.

2.4 Post-Construction Activities

The following is a general description of the post-construction activities. It is anticipated that the post construction activities will include the preparation of a report documenting the remediation of the site and the implementation of a post-remediation groundwater monitoring program.

2.4.1 Post-Remediation Reports

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A post remediation report will be prepared for submission to the appropriate regulatory agencies. The report will contain a detailed description of remediation activities, confirmatory samples, offsite disposal documentation, appropriate figures and drawings, and analytical data tables presenting results of confirmatory samples. The post remediation report will be prepared to provide a full accounting of all activities performed and documentation necessary to support the conclusion that the remedial activities met the objectives of this Remedial Action Work Plan. The report will be submitted to the CTDEP and EPA for review and ultimate approval. A separate report will be generated to satisfy the project closeout reporting requirements of the wetlands restoration efforts. The project closeout report is a likely condition of a permit or approval issued by the Army Corps of Engineers.

2.4.2 Post Remediation Groundwater Monitoring Program

Following completion of remedial activities, it will be necessary to perform post remediation groundwater monitoring of groundwater in the vicinity of Willow Brook and Willow Brook Pond. A Post-Remediation Groundwater Monitoring Program has been developed and submitted to the CTDEP and EPA. The Post-Remediation Groundwater Monitoring Program specifies groundwater monitoring wells to be sampled, field collection and analytical methods, quality assurance/quality control procedures, program duration, and reporting requirements. It is anticipated that post-remediation groundwater monitoring will be performed on a quarterly basis for a period of not less than two years.

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3.0 PROJECT SCHEDULE

The anticipated completion dates for major project activities are as follows:

- Permits from US Army Corps of Engineers, CTDEP and East Hartford July 2001
- Site Remediation Construction Period December 2001
- Site Restoration/Establishment of Vegetation June 2002
- Post Remediation Report, filing ELURs and Groundwater Monitoring Plan June 2002

A detailed project schedule is included as Figure 3-1.

4.0 FIELD SAMPLING AND ANALYSIS PLAN

4.1 Introduction

4.1.1 General

This plan addresses the field procedures, samples to be collected, sample type, sample location and the sample collection methods to be used during implementation of the remedial activities outlined in the RAWP. The Quality Assurance Project Plan (QAPP), is presented in Section 5.0.

4.1.2 Objectives of the Sampling and Analysis Plan

The overall objective of the sampling and analysis program is to provide analytical data that verify the achievement of the remediation goals for the site. The sampling program has been developed in consideration of the requirements presented in 40 CFR Part 761 Section 761.61 (c), 40 CFR Part 761 Subpart O, and the documents entitled *Verification of PCB Spill Cleanup By Sampling and Analysis*, EPA August 1985 and *Field Manual for Grid Sampling of PCB Spill Sites to Verify Cleanup*, EPA May 1986. The objective of this risk managed remediation program is to remove PCB-impacted soil and sediment exhibiting concentrations in excess of 25 ppm and place a 3-foot cap over the residual contamination areas (i.e., those areas that exhibit PCB concentrations less than 25 ppm). The proposed caps were described in previous sections. The exceptions to this approach are the wetland downgradient of the dam where excavation of soil at concentrations greater than the Residential Direct Exposure Criteria for PCBs will be performed and the area backfilled and planted to restore the wetland, and the footprint of the process water facility where soil will be remediated to meet the Residential Direct Exposure Criteria for PCBs for soils within 4-feet of the final grade, the Commercial/Industrial Direct Exposure Criteria for PCBs for soils located in inaccessible locations and the GB Pollutant Mobility Criteria for soils above the seasonal high water table, prior to the placement of backfill.

Based on the objectives of the remediation program, the following specific objectives have been established for the sampling and analysis program:

- Confirm that PCB concentrations remaining in soil/sediment/concrete and on various non-porous materials such as sheeting, shoring, conduits and pipes at the limits of the excavation are consistent with the Remedial Action (RA) objectives; and
- Determine the handling and disposal requirements for the soil/sediment/concrete and miscellaneous materials generated during implementation of the RA.

4.1.3 Overview of the Sampling and Analysis Program

Analytical results associated with samples collected as part of the RA activities will be used to document that the objectives of the RA have been satisfied. Samples that will be collected as part of the RA will consist of the following:

- Post-excavation soil/sediment/concrete samples to confirm the successful implementation of the RA and document residual contamination concentrations;

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- Post-excavation non-porous material (sheeting, shoring, conduits, pipes, etc.) samples to confirm the successful implementation of the RA and document residual contamination concentrations;
- Post PCB excavation soil sampling to confirm the limits of soil requiring remediation pursuant to the RSR (as a result of other constituent concentrations) in the vicinity of the former oil/water separator, process water facility and the wetland area;
- Concrete disposal characterization samples;
- Soil/sediment disposal characterization samples for verification of constituent concentrations; and
- Miscellaneous material samples for the assessment of disposal options and/or treatment performance (e.g., the temporary wastewater treatment system) associated with the implementation of the RA.

The location of the characterization samples performed and PCB isoconcentration contours are shown on Figures 1-2 and 1-3 for Willow Brook and Willow Brook Pond, respectively. The proposed layout of the confirmatory composite sample grid to be employed within the project limits is shown schematically in Figure 4-1. The proposed layout for the confirmatory sampling is presented on Drawing 4-1. In addition, disposal characterization samples will be collected from excavated materials associated with the RA.

4.2 Remedial Action Field Sampling

4.2.1 General

Details associated with implementing the Field Sampling Program (FSP) are presented in this section. The following information concerning the FSP is also provided:

- Proposed sample grid, sample identification numbers, and sample type;
- Procedures for sampling and for measuring field parameters; and
- A summary of the data to be generated from each sampling effort, including field and analytical parameters.

Detailed information regarding the RA field sampling including the number/type of environmental samples and quality control samples to be collected, sample intervals, analytical parameters, sample containers, preservation, and holding times are presented in tables located at the end of this section. A description of these tables is provided on the following page.

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Table No.	Title	Contents
4-1	Confirmatory Sample Summary	Presents the sample media, anticipated number of samples to be collected from the excavations, and the laboratory analytical methods.
4-2	Detailed Confirmatory Sampling Summary by Remediation Area	Presents the number and type of confirmatory samples to be collected from remediation areas at the site.
4-3	Extraction Method Summary	Presents the analytical extraction method, by analysis method, to be utilized for each type of solid sample media anticipated to be collected during the implementation of the remedial action.
4-4	Quality Control Analyses Summary	Indicates the number and type of quality assurance/quality control (QA/QC) samples, which will be collected during the implementation of the remedial action.
4-5	Required Containers, Preservatives, and Analysis Holding Times for Solid, Aqueous, and Vapor Samples	Indicates the appropriate sample containers, preservation methods, and holding times for the samples to be collected.

All sampling activities will be performed in accordance with the Loureiro Engineering Associates, Inc. SOPs provided in Appendix B.

4.2.2 Post-Excavation Confirmatory Sampling

Post-excavation confirmatory sampling of soil/sediment/concrete and non-porous materials will be conducted in the areas to be excavated (Drawing 2-3) to confirm that residual PCB concentrations do not exceed the RA objectives at the limits of the excavations. The RA objectives are as follows: 25 ppm PCBs for soil/sediment/concrete and 100 µg/100 cm² for all non-porous materials in all areas to be capped; GB Pollutant Mobility Criteria for all uncapped soil above the seasonal high water table; the Commercial/Industrial Direct Exposure Criteria for soil/concrete in inaccessible locations within and immediately adjacent to the process water buildings; the Residential Direct Exposure Criteria for soil/sediment/concrete in the wetland area to the north of the stream channel and 10 µg/100 cm² for non-porous materials in all uncapped locations. The proposed layout for the confirmatory sampling is presented on Drawing 4-1. Confirmatory soil sampling will be performed throughout the project as necessary to document the adequacy of the remedial measures as proposed.

PCB Confirmatory Soil Sampling – Engineered Control Areas

The approach for the verification of remediation in engineered control areas at the site will consist of the collection of composite soil samples from the bottom and sidewalls of the excavation. Bottom composite sampling will be performed at a rate of one sample representing a 1,600 square foot area (equating to a 20 by 20-foot grid spacing) and a rate of one composite sample representing a 320 square foot area of sidewall excavation. This approach is being proposed based on the lack of variability and low degree of contamination at the depths of excavation proposed to achieve the RA objectives the degree of lateral variability observed in the existing dataset. The actual number of composite samples to be collected in a given remediation area will be determined based on the lateral limits of the area upon final excavation. A

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schematic layout of composite sample locations within engineered control areas is provided as Drawing 4-1. A summary of the confirmatory sampling to be performed for the project is provided as Table 4-2.

To confirm the vertical extent of remediation, post-excavation confirmatory soil/sediment samples for PCBs will be collected from the bottom of the excavated areas which will be located beneath the engineered controls within Willow Brook, Willow Brook Pond, and the oil-water separator area as defined above at a frequency of one sample per 400 square feet, which equates to a 20-foot grid spacing. Grab samples will be obtained on each grid node. A maximum of four grab samples from adjacent grid nodes will be composited into one sample in the field for PCB analysis in the laboratory. This analysis will represent the respective 1,600 +/- square foot area as shown in Figure 4-1. The sampling points will proceed in every direction to the extent sufficient to result in a comprehensive two-dimensional grid completely overlaying the bottom of the excavation area. Judgmental samples would be added as appropriate based upon field observations (i.e. discoloration or stratification) and as needed to adequately represent the floor area of each remediation area. Based on the available analytical data and related proposed limits of the remedial excavation, Drawing 4-1 (Potential Confirmatory Sample Locations) was prepared to demonstrate the expected layout of the bottom composite sampling grid. As noted, additional judgmental samples will be collected, as appropriate. Due to the irregular shape of remediation areas within the limits of the project and the coverage provided by the proposed grid layout, should remediation be completed to the limits shown on Drawing 4-1, each composite bottom sample would be representative of 1,200 square feet of excavation area. This is an approximately 25 percent greater sampling density than the proposed rate of one sample per 1,600 square feet. It is anticipated that during implementation of remediation, a similar sampling density to that depicted on Drawing 4-1 and Table 4-2 will be realized.

The grid spacing for the analysis of the vertical extent of remediation in engineered control areas within Willow Brook and Willow Brook Pond is appropriate as remediation within these areas of the site will result in the excavation of nearly all sediment and the contaminant delineation investigation performed prior to remediation indicate that PCB contamination is coincident with the sediment and the underlying sand material was shown to contain PCBs at concentrations significantly lower than 25 ppm. In fact, the PCB concentrations in the underlying sand approach 1 ppm. The grid spacing for the analysis of the vertical extent of remediation in the vicinity of the oil/water separator area is also appropriate. To complete the removal of the oil/water separator (the source of contamination in this area) and to achieve a 25-ppm goal, the excavation activities will result in the removal of nearly all soil to a depth of the bottom of the former structure. The contaminant delineation investigation performed prior to remediation indicated that PCB concentrations at depths beneath the separator are significantly lower than 25 ppm.

In order to document the adequacy of the lateral extent of the remediation within the engineered control areas, composite samples will be collected from the vertical sidewall of the excavations at a rate of not less than 1 composite sample per 320 square feet of sidewall. Each composite sample will be comprised of not more than four individual aliquot samples. Individual aliquot samples will be collected at a rate of one sample per 4-vertical feet every 20 linear feet along the sidewall. This sampling pattern will be enhanced with judgmental samples as needed based on field observations. The sampling density for sidewall sampling is greater than the sampling density proposed for assessing vertical extent of remediation in the engineered control areas. The rationale for the performance of composite samples for sidewalls of excavations (rather than a combined sidewall and bottom composite sampling scheme) is based on the fact that soil and sediment samples collected during the performance of contaminant delineation investigations indicated a degree of variability in comparison to a low degree of variability in samples collected from beneath the bottom sediments. This approach will yield data adequate to assess the lateral limits of excavation as sidewall samples will be taken from undisturbed sediments and soils along the lateral limits of each excavation area and will not be combined with aliquots from the bottom of

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excavations. Based on lateral limits defined for each excavation area, the proposed sampling approach will adequately address potential variability in sediment concentrations to ensure that the RA objective of 25-ppm for these areas of the site will be met. As shown in Table 4-2, though sampling is to be performed at a rate of one sample per 320 square feet of sidewall of excavation, should excavation be performed to the limits shown on Drawing 4-1, the size and irregular shape of remediation areas would result in each sidewall composite sample being representative of 270 square feet of excavation area. A 15 percent increase in sampling density. As with bottom composite sampling, it is anticipated that similar density will be encountered during implementation of remediation at the site.

Evaluation of the composite data for PCBs would be based upon a direct comparison of the sample data to the 25 ppm criteria. More specifically, any result for a composite sample below 25 ppm in a 25-ppm target area located beneath the engineered control would result in the conclusion that remediation in those areas has been completed.

PCB Confirmatory Soil Sampling – Non-Engineered Control Areas

The following is a summary of the non-engineered control areas at the site:

- The wetland area which will be remediated to less than the Residential Direct Exposure Criteria for PCBs and less than the Commercial/Industrial Direct Exposure Criteria for other constituents;
- A small area in the vicinity of WT-SB-132 which will be remediated to meet the Commercial/Industrial Direct Exposure Criteria for PCBs for soils located in inaccessible locations and the GB Pollutant Mobility Criteria for all constituents in soils above the seasonal high water table as previously described; and
- The footprint of the process water facility which will be remediated to meet the Commercial/Industrial Direct Exposure Criteria for PCBs for soils located in inaccessible locations and the GB Pollutant Mobility Criteria for all constituents in soils above the seasonal high water table.

The approach for the verification of remediation in non-engineered control areas at the site will consist of the collection of both composite and grab soil samples from the bottom and sidewalls of the excavation. Bottom composite sampling will be performed at a rate of one sample per 1,600 square feet of excavation (20 by 20-foot grid spacing). As the non-engineered control areas must also be remediated in a manner consistent with the RSR, individual grab samples will also be collected from the center of each of the 20 by 20-foot grid squares utilized for bottom composite sampling (a rate of one sample per 1,600 square feet of excavation area). In order to document the adequacy of the lateral extent of the remediation within these areas, soil grab samples will be obtained from the sidewalls of the excavations at varying depths at a rate of not less than 1-sample per 320 square feet of excavation sidewall. This sampling pattern will be enhanced with judgmental samples as needed based on field observations (i.e. stratification, discoloration, etc.).

This approach is being proposed based on the lack of variability and degree of contamination at the depths of excavation proposed to achieve the RA objectives and the degree of lateral variability observed in the existing dataset.

Evaluation of grab sample data for PCBs in an area to be remediated to the RDEC would be based on a comparison of the grab sample data to the RDEC. Evaluation of grab sample data for PCBs in an area to be remediated to the IDEC (soils at depths greater than 4 feet in the footprint of the former process water facility) would be based on a comparison of the grab sample data to the IDEC. This determination will

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also include consideration of composite data as well. Evaluation of the composite data for PCBs would be based upon a direct comparison of the sample data to the RDEC. More specifically, any result for a composite sample must be below the numeric RDEC in an area to be remediated to the RDEC and any result for a composite sample must be below the IDEC in an area to be remediated to the IDEC. However, the grab sample data will govern the overall determination of compliance.

Confirmatory Soil Sampling for Constituents Other than PCBs

As defined by the available analytical data, there are other constituents of concern that are noted in soil and sediment within the project area. These other constituents include metals, VOCs, SVOCs, TPH and cyanide. The remediation is designed to address these constituents as well as PCBs. Remediation of other constituents of concern found in the remediation areas will be completed in accordance with the RSR as follows:

- In all areas to be provided with an engineered control, no numeric goals for other constituents apply as the areas are being addressed in accordance with the variance provision in the RSR thereby allowing soils exceeding the tabular criteria to be left in place (no sampling proposed);
- The wetland area which will be remediated to less than the Residential Direct Exposure Criteria for PCBs and less than the Commercial/Industrial Direct Exposure Criteria for other constituents;
- A small area in the vicinity of WT-SB-132 which will be remediated to meet the Commercial/Industrial Direct Exposure Criteria for PCBs for soils located in inaccessible locations and the GB Pollutant Mobility Criteria for all constituents in soils above the seasonal high water table as previously described; and
- The footprint of the process water facility which will be remediated to meet the Commercial/Industrial Direct Exposure Criteria for PCBs for soils located in inaccessible locations and the GB Pollutant Mobility Criteria for all constituents in soils above the seasonal high water table.

As discussed earlier in this section, the lateral extent of remediation in two specific areas of the site will need to be evaluated (in the vicinity of the former oil/water separator and within the wetland area). In order to document the adequacy of the lateral extent of the remediation within the wetland area, soil grab samples will be obtained from the sidewalls of the excavations at a rate of one grab sample per 320 square feet of sidewall of excavation. This sampling pattern will be enhanced with judgmental samples as needed based on field observations. This pattern would be implemented on the northern, eastern and western sidewalls of the wetland remediation area. Since the wetland area will be restored without a cap, floor sampling for constituents of concern other than PCBs will be necessary. Floor sampling will be accomplished by obtaining one grab sample at the center point of the four adjacent grab sample locations defined for PCB sampling. This analysis will represent the respective 1,600 +/- square foot area as shown in Figure 4-1.

For the oil/water separator area, the excavation will proceed until the results of the previously described PCB confirmatory sampling verify removal of all soil and sediment containing greater than 25 ppm PCBs. The limits of the composite cap to be installed over this area will be defined through additional soil sampling and analysis discussed in Section 2.0. The initial sampling locations are shown on Drawing 4-1. Additional soil borings would be added, as necessary, to delineate the three-dimensional extent of soils impacted by constituents other than PCBs (i.e. metals, cyanide, VOCs, SVOCs, and TPH). It is anticipated that soils requiring remediation for constituents other than PCBs extends beyond the lateral limits of soil impacted by greater than 25 ppm PCBs. As a result, following excavation of soils greater than 25 ppm PCBs, non-RCRA soils from the upper three-feet outside the lateral limits of the PCB

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excavation, but within the limits defined as requiring remediation for other constituents pursuant to the RSRs, will be stripped and used to backfill the PCB excavation. Confirmatory sidewall grab sampling as described above for the wetland area will be implemented to ensure all soils requiring remediation pursuant to the RSR will be located beneath the composite cap.

The analytical data derived from these analyses for other constituents would be compared to the appropriate criteria presented in the RSR. As noted above, exceedances would be addressed by extension of the cap or further remediation, as appropriate.

PCB Confirmatory Concrete Sampling

Although the majority of the known concrete structures in contact with PCB contaminated soil will be demolished then excavated and disposed of along with the adjacent soil, some structures may be left in place for reuse. Examples of these structures are reinforced concrete pipes, dams and other miscellaneous concrete structures.

Concrete samples will be obtained by chipping the surface to a maximum depth of two inches in accordance with the SOP included in Appendix B. The approach for the verification of remediation for concrete structures located within PCB remediation areas at the site will consist of the collection of composite chip samples from the various surfaces of the subject structure. Concrete sampling will be performed at a rate of one discrete sample representing a 320+/- square foot area (equating to a 3 by 3-meter grid spacing). This grid spacing is proposed based on the historic nature and long duration of contact between the concrete and the PCB contaminated soil and sediment. A high degree of variability of PCB concentrations in concrete is not expected.

Since most of the known concrete structures in contact with PCB contaminated soil will be excavated and disposed of along with the adjacent soil, no specific concrete sample locations are included on the attached schematic layout of composite sample locations (Drawing 4-1). Similarly, concrete sampling has not been specifically defined in number in Tables 4-1 or 4-2, however, the need for concrete sampling is acknowledged by the inclusion into the overall confirmatory sampling requirements.

Evaluation of the discrete sampling data for PCBs would be based upon a direct comparison of the concrete sample data to the RA objective of 25 ppm PCBs for concrete in all areas with land use restrictions and 1 ppm for all other areas.

PCB Confirmatory Non-porous Material Sampling

As with the concrete structures noted above, the majority of the known non-porous materials in contact with PCB contaminated soil will be demolished then excavated and disposed of along with the adjacent soil. However, some structures may be left in place for reuse.

The approach for the verification of remediation on non-porous surfaces at the site will consist of the collection of individual wipe samples from the surfaces of the materials that were determined to be in contact with PCB contaminated soils. Wipe sampling of non-porous surfaces will be performed on 100 cm² areas within 1-meter grid nodes. Grid nodes designated for sampling will be randomly selected to cover 10 percent of the total surface area represented. Wipe sampling will be performed in strict accordance with the SOP included in Appendix B.

Since most of the known non-porous structures in contact with PCB contaminated soil will be excavated and disposed of along with the adjacent soil, no specific wipe sample locations are included on the

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attached schematic layout of composite sample locations (Drawing 4-1). Similarly, wipe sampling has not been specifically defined in number in Tables 4-1 or 4-2, however, the need for wipe sampling is acknowledged by the inclusion into the overall confirmatory sampling requirements.

Evaluation of the discrete sampling data for PCBs would be based upon a direct comparison of the wipe sample data to the RA objective of 100 $\mu\text{g}/100\text{ cm}^2$ for all non-porous materials in all areas to be capped and 10 $\mu\text{g}/100\text{ cm}^2$ for all non-porous materials located in uncapped areas. Land use restrictions for access, as necessary, will be required in these areas.

Soil/Sediment Sample Collection

Procedures for collecting post-excavation PCB confirmatory soil/sediment composite samples are presented as follows:

- Soil/sediment will be collected from each of the discrete sampling locations through the use of a calibrated disposable syringe. One syringe will be used for each composite sample unless the integrity of the syringe is questionable or it becomes clogged. The individual grab samples will be used to form a single composite sample in the field.
- Each aliquot will be examined for the presence or likelihood of free liquid. If these features appear, the aliquot(s) will be allowed to "rest" so that any free water can be decanted prior to compositing. In such cases, dedicated syringes will be used to facilitate timely completion of the sampling task.
- The aliquots will be composited and mixed thoroughly in the laboratory-supplied glassware.
- At the laboratory, a final sample, of sufficient weight and volume will be collected from the composite and then extracted and analyzed for the PCBs in accordance with the EPA methods described in Tables 4-1 and 4-3.
- A second portion of the sample will be weighed out at the same time as the portion to be used for analytical determination. This portion will be weighed, oven-dried and used to calculate the percent dry weight of the sample. The oven-dried aliquot will not be extracted or used for analytical determination.

Procedures for collecting vertical and lateral limit confirmatory grab soil samples (constituents other than PCBs) are presented as follows:

- Soil will be collected from each of the discrete sampling locations. The individual grab samples will not be used to form a composite sample.
- A sample, of sufficient weight and volume will be obtained from the sample container, extracted and analyzed to represent the post-excavated confirmatory soil present.
- Samples for VOC analysis will be collected in accordance with SW-846 Method 5035.
- A second portion of the sample will be weighed out at the same time as the portion to be used for analytical determination. This portion will be weighed, oven-dried and used to calculate the percent dry weight of the sample. The oven-dried aliquot will not be extracted or used for analytical determination.

Soil/sediment samples shall be collected using disposable sampling equipment or decontaminated spatulas, split-spoon samplers, augers or an equivalent. All disposable components of a sampling device will be disposed of prior to sample collection and all fixed components of a sampling device will be decontaminated prior to sample collection. The materials and procedures to collect post-excavation confirmatory soil/sediment samples are presented below.

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- Appropriate health and safety equipment;
- Plastic sheeting;
- Tape measure (50 feet or greater);
- Appropriate soil sample containers;
- Appropriate transport containers (coolers) with ice and appropriate labeling, packing, and shipping materials;
- Field forms and labels;
- Chain-of-custody forms; and
- Site map with post-excavation confirmatory soil/sediment locations.

Each component of the sampling device will be decontaminated or replaced with a new, dedicated, or disposable component prior to collecting soil/sediment samples for laboratory analysis. The sampling equipment will be decontaminated as previously discussed.

A portion of each confirmatory soil sample will be used for visual and hand texture characterization as necessary to describe the material sampled in the field sampling forms. In addition, field analysis will be conducted to determine if PCB concentrations are above or below the RA objective of 25 ppm. The field analysis will be performed using screening tests, as for example, rapid immunoassay screen test kits. The PCB field test kits are a semi-quantitative screening method that determines whether the total PCB concentration is above or below the specified threshold values by comparison with a standard. Rapid immunoassay screen tests will not be used to determine final compliance with the RA objectives, rather they will be used as a means to direct the need for further excavation prior to embarking on final confirmatory sampling and analysis at a fixed laboratory in accordance with the procedures outlined above. The manufacturer will provide standard operating procedures for PCB field test kits. Final confirmatory samples will be submitted to the laboratory for analysis for PCBs (USEPA SW-846 Method 8082 revised Jan. 1998).

QA/QC soil/sediment samples will also be collected as described in Section 4.6.2 and in the QAPP presented in Section 5.0. Trip blanks, equipment blanks, duplicate samples and performance evaluation samples will be submitted for analysis. Table 4-1 presents the number of soil/sediment samples to be collected, and Table 4-4 presents the associated QA/QC soil sampling frequencies. Samples will be placed in appropriate laboratory supplied sample containers, preserved as described in Section 4.4.1, and labeled as described in Section 4.4.2. The samples will be handled, packaged, and shipped under appropriate chain-of-custody procedures as presented in Section 4.4.3.

Concrete Sample Collection

Procedures for collecting post-excavation PCB confirmatory concrete grab samples are presented as follows:

- The subject area will be measured, sketched and gridded to a 3 by 3-meter grid spacing.
- Concrete chip samples will be collected from each of the discrete sampling locations through the use of an impact drill equipped with a stone chisel inserted through the center of a five foot square section of plastic sheeting (to limit the dispersion of dust during sample collection).
- Samples shall be obtained by chipping of the concrete surface to a maximum depth of two inches.
- At the laboratory, the chips are crushed and maulled into a ubiquitous granular material and then extracted and analyzed for the PCBs in accordance with the EPA methods described in Tables 4-1 and 4-3.

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- A second portion of the sample will be weighed out at the same time as the portion to be used for analytical determination. This portion will be weighed, oven-dried and used to calculate the percent dry weight of the sample. The oven-dried aliquot will not be extracted or used for analytical determination.

All concrete sampling equipment will be subject to decontamination procedures prior to sampling, consistent with the SOP included in Appendix B. . In general, all excess loose concrete and debris shall be removed from the sampling equipment. Sampling equipment shall then be immersed in an Alconox/Liquinox and tap water solution and scrubbed to remove all debris. The sampling tool will then be processed through several rinse/wash procedures in specific order as follows:

1. Detergent scrub
2. Deionized (DI) water rinse
3. Hexane rinse
4. DI water rinse
5. 10 percent nitric acid rinse
6. DI water rinse
7. 10 percent methanol rinse
8. Air dry

Final confirmatory samples will be submitted to the laboratory for analysis for PCBs (USEPA SW-846 Method 8082 revised Jan. 1998).

QA/QC concrete samples will also be collected as described in Section 4.6.2 and in the QAPP presented in Section 5.0. Trip blanks, equipment blanks, duplicate samples and performance evaluation samples will be submitted for analysis. Samples will be placed in appropriate laboratory supplied sample containers, preserved as described in Section 4.4.1, and labeled as described in Section 4.4.2. The samples will be handled, packaged, and shipped under appropriate chain-of-custody procedures as presented in Section 4.4.3.

PCB Confirmatory Non-Porous Surface Sampling

Procedures for collecting post-excavation PCB confirmatory wipe samples from non-porous materials are presented as follows:

- The subject area will be measured, sketched and gridded to a 1 by 1-meter grid spacing.
- Grid nodes will be randomly selected to cover 10 percent of the total surface area using a random number generator.
- A standard-size template (10 cm x 10 cm) will be used to delineate the area for wiping.
- A 2-inch square sterilized gauze pad shall be saturated with hexane (prepared by the laboratory or in the field laboratory prior to sampling). The wiping medium will be stored in sealed glass vials until it is used for the wipe test.
- The pad will be used to thoroughly wipe over the sampling surface exposed inside the template. The wipe will be performed very quickly after the hexane is exposed to air.
- The pad will then be deposited into a clean-labeled 4-ounce jar for shipment to the laboratory.

Wipe samples shall be collected using disposable sampling equipment including dedicated templates. All sampling equipment will be disposed of immediately after completion of the sampling. Final

confirmatory samples will be submitted to the laboratory for analysis for PCBs (USEPA SW-846 Method 8082 revised Jan. 1998).

QA/QC (field blanks and duplicate samples) will also be collected as described in Section 4.6.2 and in the QAPP presented in Section 5.0. Most of the non-porous structures anticipated are not presently exposed. Consequently, no estimate to the number of samples necessary to confirm these structures is presented. This evaluation will be made upon discovering these items via excavation. All samples will be handled, packaged, and shipped under appropriate chain-of-custody procedures as presented in Section 4.

4.2.3 Disposal Characterization Sampling

Contaminated soil and sediment will be characterized for disposal based on the "as-found" concentration of PCBs in accordance with 40 CFR 761.61. This data will establish the basis for segregation within the staging areas. Additional analysis will be performed on stockpile grab samples as needed to satisfy the disposal vendor. Additional analytes beyond PCBs may include metals, VOCs, SVOCs, pesticides and herbicides, TPH, or cyanide as appropriate for thorough characterization. The waste will be disposed of based upon the more restrictive analytical data regardless of the as-found concentrations (e.g. if in-situ characterization documents < 50 ppm PCBs and the stockpile data suggests > 50 ppm, the waste disposal profile used for this particular load would be based on the stockpile data). Stockpile analytical data would not be used to reduce any disposal restrictions on the material.

A minimum of two and a maximum of four separate waste streams are expected. The minimum two waste streams are PCB remediation waste (PCBs > 50 mg/kg) and PCB remediation waste (PCBs < 50 mg/kg). The additional two waste streams would include the above minimum two but with the addition of other underlying hazardous constituents. Supplemental analysis (for PCBs as well as other constituents of concern) will be performed for disposal vendor satisfaction and for disposal characterization of the concrete debris from demolition of the process water facility and the former oil/water separator. Supplemental analysis for disposal vendor satisfaction will be performed from stockpile grab samples using a random node sampling technique. Disposal characterization sampling of concrete debris will be performed at a rate of approximately 1 sample per 500 tons of concrete debris or at a more frequent rate as directed by the disposal vendor.

4.2.4 Miscellaneous Sampling

In addition to the sampling activities described above, additional sampling may be performed to determine handling and disposal requirements. These samples may include effluent samples from the temporary wastewater treatment system and debris from the demolition of the existing process water facility. A description of the sampling and analysis to be conducted for each of these materials is presented below.

Effluent Samples from the Temporary Wastewater Treatment System

Surface water or groundwater that enters the active remedial excavations and water generated from soil/sediment dewatering activities will be pumped to on-site storage tanks and treated on site at a temporary wastewater treatment system. During normal operation of the temporary wastewater treatment system, effluent samples will be collected and analyzed for specific parameters as required by the general permit or Temporary Authorization. Effluent samples will be collected and analyzed in accordance to the frequency specified by the general permit or Temporary Authorization to confirm that discharge permit limits are achieved.

4.3 Sample Designation System

4.3.1 Sample Codes

A six-digit designation code and sample date will provide each sample with a unique sample identification number. This alphanumeric system will apply to all samples collected and submitted to the designated laboratory for analysis. The designation codes that will be used for the samples collected, as part of the RA, are presented on the following page.

Sample Type	Sample Location Designation
Confirmatory Soil/Sediment/concrete/wipe Samples	<ul style="list-style-type: none">• A prefix indicating that the sample was collected in the Waste Treatment area (WT-)• A designation (CS) indicating that the sample is a confirmatory sample;• A consecutive number indicating the sample collected.
Disposal Characterization Soil/Sediment/concrete/wipe Samples	<ul style="list-style-type: none">• A prefix indicating that the sample was collected in the Waste Treatment area (WT-)• A designation (DC-) indicating that the sample is a disposal characterization sample;• A consecutive number indicating the sample collected.
Temporary Wastewater Treatment System Effluent Samples	<ul style="list-style-type: none">• A prefix indicating that the sample was collected in the Waste Treatment area (WT-)• Samples of the effluent water from the treatment system will contain the designation (EW) followed by a consecutive sample number.

Blind sample numbers will be assigned to the samples submitted to the laboratory for QA/QC purposes. The blind sample numbers will be associated with the sample location designations only in the field forms.

4.4 Sample Handling and Documentation

4.4.1 Sample Containers and Preservation

Appropriate sample containers, preservation methods, and laboratory holding times for samples collected as part of the RA are shown in Table 4-5. The analytical laboratory will supply appropriate sample containers, sample labels, and preservatives.

An example of a sample label, custody seal, field sampling record and chain-of-custody form are included in Figures 4-2 through 4-5, respectively.

4.4.2 Packing, Handling, and Shipping Requirements

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Sample custody seals and packing materials for filled sample containers will also be provided by the analytical laboratory. The filled, labeled, and sealed containers will be placed in a cooler with ice and packed to eliminate the possibility of container breakage.

All samples will be packaged by the field personnel and transported as low concentration environmental samples. The packaged samples will be shipped either by carrier or hand delivered to the laboratory within 36 hours of sample collection.

4.4.3 Documentation

Field personnel will provide documentation for all aspects of field sampling, field analysis, and sample chain-of-custody. This documentation constitutes a record, which allows reconstruction of all field events to aid in the data review and interpretation process. All documents, records, and information relating to the performance of the fieldwork will be retained in the project file.

Various forms of documentation to be maintained throughout the RA include:

- Daily Production Documentation – Daily field forms containing a record of all field sampling activities.
- Sampling Information – Detailed notes will be made concerning the sample location, physical observations, sample depths, and weather conditions.
- Chain-of-Custody – Chain-of-custody forms will provide the record of responsibility for sample collection, transport, and submittal to the laboratory. Chain-of-custody forms will be filled out at each sampling site, at a group of sampling sites, or at the end of each day of sampling by one of the field personnel designated to be responsible for sample custody.
- Field Equipment Calibration, and Maintenance Logs – To document the calibration and maintenance of field instrumentation, calibration and maintenance logs will be maintained for each piece of field equipment.

4.4.4 Electronic Database

All data including field and analytical data collected will be maintained in a site-specific electronic database. The database already contains all characterization data obtained during the Willow Brook and Willow Brook Pond investigations to date. All data entered in the database will be verified for accuracy.

4.5 Management of Sampling-Related Materials and Wastes

The handling of sampling related materials and wastes is discussed below.

4.5.1 Disposable Equipment and Debris

Disposable equipment and debris, such as health and safety equipment, plastic sheeting, sampling equipment, and other equipment and/or sampling debris not reused during the RA will be collected in plastic bags during sampling and disposed of as PCB remediation waste (PCB >50ppm) and would be included in the soil loads in accordance with the miscellaneous H&S waste provisions permitted under the standard disposal profile.

4.5.2 Decontamination Rinsate

Decontamination rinsate will be containerized at a controlled, centralized location in an appropriate temporary storage container or in labeled 55-gallon drums. Upon completion of the field sampling activities, the rinsate will be treated to comply with the maximum allowable concentrations stipulated in the General Permit for the Discharge of Groundwater Remediation Wastewater prior to discharge to the sanitary sewer.

4.6 Field Quality Assurance/Quality Control

This section summarizes the Quality Assurance/Quality Control (QA/QC) requirements for sampling activities associated with the RA at the site. Table 5-5 includes accuracy and precision data for field instrumentation.

4.6.1 Field Instrument Calibration and Preventative Maintenance

Field personnel will document the calibration and maintenance of all applicable field equipment in the appropriate field forms. Table 5-4 details the frequency at which field instruments will be calibrated.

4.6.2 QA/QC Sample Collection

QA/QC samples will be collected at a frequency of one every 20 samples and submitted to the laboratory for analysis. The number of QA/QC field samples to be collected is provided in Table 4-4. The type of QA/QC samples to be collected during the RA includes trip blanks, equipment blanks, duplicate samples, aqueous performance evaluation (PE) samples, and matrix spike/matrix spike duplicate (MS/MSD) samples. Guidance on the collection of the QA/QC samples is presented below:

Trip Blanks

Trip blanks will be collected at a frequency of one every 20 samples or one per cooler per day to ensure that the samples are not contaminated by VOCs while in transit to the laboratory. The trip blanks will be prepared by the laboratory and delivered along with the sample glassware. No trip blanks will be collected in sample batches that do not include analysis for VOCs.

Equipment Blanks

Equipment blanks are collected as a check that the decontamination procedure has been adequately performed and that cross-contamination of samples will not occur due to the sampling equipment. Equipment blanks will be prepared in the field by pouring laboratory supplied analyte-free water into or over decontaminated sampling equipment and then directly into the laboratory supplied sample bottles.

For wipe samples, equipment blanks will be collected by placing hexane on the wipe gauze and then wiping the surface of a disposable template.

One equipment blank will be collected for each representative type of equipment used (i.e., templates, chisels, spoons, bowls, split-spoon sampler, etc.) for every 20 samples collected and/or at a minimum of once per week.

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Field Duplicate Samples

Field duplicates will be submitted at the rate of one for every twenty samples, per matrix. Field duplicates are collected as collocated samples. Soil samples will be thoroughly mixed and homogenized and transferred to the appropriate sample containers. If standing water is noted on the soil sample, the LEA field technician will attempt to dry the sediment by placing soils on an absorbent pad to wick away water from the sample. The field technician will also attempt to prevent larger grained particles (gravel and cobbles) from being included in the sample to promote homogeneity. Following dewatering the sample, the soil samples will be placed directly into appropriate sample glass jars. Soil samples will then be placed into sample coolers.

Duplicate concrete chip samples will be thoroughly mixed then transferred to the appropriate sample containers. Care will be taken to evenly distribute the chips into the two sample jars. Concrete samples will then be placed into sample coolers.

Duplicate wipe samples shall be collected by wiping a surface area adjacent to the original sample location using the same procedures. Care will be taken to select similar surface characteristics (such as rust, paint, discoloration, etc.) for duplicate sample locations. Wipe samples will be placed in appropriate sample containers and then placed into sample coolers.

Field duplicates provide precision information regarding homogeneity and distribution of the contaminants; they measure the bias of sub-sampling.

Duplicate samples will be sent for laboratory analysis to evaluate the reproducibility of the sampling technique used.

Performance Evaluation Samples

Performance evaluation samples will be sent for laboratory analysis to ensure that environmental data collection results in the delivery of analytical data of known and documented quality, suitable for its use. Aqueous PE samples for each suite of analytes (PCBs, metals, VOCs, SVOCs, TPH, and cyanide as applicable) will be analyzed at a frequency of one every 20 samples analyzed. The analytical results of the PE samples will be compared with vendor-certified acceptance limits and the resulting data will be evaluated and qualified following USEPA Region I Performance Evaluation Sample Guidance – Attachment H, July 1996. The PE samples will be counted as field samples in the 20-sample SDG total.

5.0 QUALITY ASSURANCE PROJECT PLAN

5.1 Introduction

The QAPP discusses objectives and QA/QC protocols to be used to achieve the Data Quality Objectives (DQOs) for the delineation and removal of selected soils and sediments associated with the remediation of Polychlorinated Biphenyl (PCB) contaminated sediment within Willow Brook and Willow Brook Pond at the United Technologies Corporation (UTC), Pratt & Whitney (P&W) manufacturing facility in East Hartford, Connecticut (Site). The remedial approach consists of the excavation and offsite disposal of soil and sediment from within and immediately surrounding Willow Brook and Willow Brook Pond that contains PCBs at concentrations greater than 25 milligrams per kilogram (mg/kg or parts per million (ppm)).

5.1.1 General

This Quality Assurance Project Plan (QAPP) has been prepared with reference to the guidance as presented in the *Region I, EPA-New England Compendium of Quality Assurance Project Plan Requirements and Guidance* document and Attachment A to this document *Region I, EPA New England Quality Assurance Project Plan Manual (QAPP Manual)*. Analytical methods and procedures as presented in SW-846 will be used during implementation of the Remedial Action (RA), as outlined in the Remedial Action Work Plan, (RAWP).

5.1.2 Objectives of the Quality Assurance Project Plan

Quality assurance objectives are generally defined in terms of Data Quality Indicators (DQIs formally known as PARCCS parameters). DQIs are comprised of five parameters: precision, accuracy, representativeness, completeness, and comparability. These parameters are defined in sections 5.3.6 through 5.3.10 of this QAPP. The measurement performance criteria for confirmatory data will be evaluated during the Tier II data validation, which will be performed in accordance with the Region 1, EPA New England Functional Guidelines for Data Validation.

The objective of the QAPP is to present the quality assurance/quality control (QA/QC) procedures to be implemented during the RA. The QAPP ensures that the data generated is of sufficient quality and quantity to allow confirmation that the RA objectives for the site are achieved. The sampling objectives of the QAPP are as follows:

- Confirm that residual PCB soil/sediment/concrete and miscellaneous non-porous material concentrations (at the horizontal and vertical limits of the excavation) satisfy the objectives of the RA;
- Determine handling and disposal requirements for the soil/sediments generated during the RA; and,
- Determine handling and disposal requirements for the miscellaneous materials generated during the RA.

5.1.3 Remedial Action Data Quality Objectives

To obtain data necessary to meet the objectives previously stated, the following categories of field sampling will be conducted as part of the RA:

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- Post-excavation confirmatory soil/sediment/concrete and non-porous media samples to confirm the successful implementation of the RA and document residual contamination concentrations.
- Soil/sediment/concrete and non-porous disposal characterization samples for assessment of disposal options; and
- Miscellaneous material samples for the assessment of disposal options and/or treatment performance (e.g., the temporary wastewater treatment system) associated with the implementation of the RA.

Preliminary Data Quality Objectives (DQOs) were identified to ensure that the data generated during field sampling will be of adequate quality and sufficient quantity to form a sound basis for decision making purposes relative to the above objectives. DQOs have been specified for each data collection activity.

DQO summaries for the RA activities are presented in the following section. The summary consists of stated DQOs relative to the following items:

- Data Uses;
- Data Types;
- Data Quality;
- Data Quantity;
- Sampling and Analytical Methods; and
- Data Precision, Accuracy, Representativeness, Completeness, and Comparability Parameters (DQIs formally known as PARCCS).

The categories of analytical data discussed in the following sections with regard to data quality are defined as follows:

Screening Data: Screening data will be used to provide a quick assessment of site characteristics or conditions. Data collection activities involve rapid, non-rigorous methods of analysis and quality assurance. This includes field measurements such as immunoassay test kit results. This data will be reviewed and verified for accuracy and completeness as the field forms are processed by the LEA task manager.

Disposal Characterization Data: This includes all disposal characterization data, debris sampling and routine wastewater sampling prior to discharge. This data will be generated by a state-certified laboratory using EPA-approved analytical methods. The data will be reviewed for accuracy and data verification will be performed. This data will also be entered in the site-specific database. No data validation will be performed.

Confirmatory Data: Confirmatory data will be generated from a state-certified analytical laboratory using EPA-approved analytical methods. The data will be reviewed for accuracy, precision, representativeness, completeness and comparability. A complete Tier II data validation will be performed on all confirmatory data obtained. The validation will be performed in accordance with USEPA Region I Functional Guidelines for Data Validation. This analytical data will be entered in the site-specific database as will the qualifiers added to the data as a result of the Tier II data validation. Written Data Validation memoranda including data tables will be on file for each SDG containing confirmatory sampling data.

5.1.4 Post-Excavation Confirmatory Soil/Sediment/Concrete and Non-porous Material Sampling

Data Uses

Post-excavation confirmatory soil/sediment/concrete and non-porous material sampling will be conducted to confirm that residual concentrations of PCBs, metals, VOCs, SVOCs, TPH, and cyanide (if applicable) present at the limits of excavations in the excavated areas are below the RA objectives.

Data Types

Confirmatory soil/sediment/concrete and non-porous material sampling will include the collection and analysis of samples for PCBs, metals, VOCs, SVOCs, TPH, and cyanide (if applicable). Table 4-1 of the QAPP presents the anticipated number of confirmatory soil/sediment samples to be collected and the laboratory analysis to be performed. Visual observation, and field screening of soil/sediment samples using PCB immunoassay field test kits will also be conducted to select soil/sediment samples for laboratory analysis. No field screening will be performed for concrete and non-porous material.

Data Quality

Sample analysis for PCBs, metals, VOCs, SVOCs, and cyanide (if applicable) will be conducted in accordance with the methods referenced in the USEPA document SW-846. TPH analysis will be conducted by SW-846 Method 418.1. In addition, field screening of soil/sediment samples will be performed using PCB immunoassay field test kits in accordance with the (SOPs), which have been provided by the manufacturer and are included in Appendix B. Fixed laboratory results will be presented using a Tier II laboratory data quality package and final electronic deliverables.

QA/QC samples will be performed for the confirmatory soil/sediment/concrete and non-porous material samples collected. The number and type of QA/QC soil/sediment samples to be analyzed are summarized in Table 4-4. The number of concrete and/or wipe samples is not quantified, as these sampling techniques will be infrequent in nature and will only be used in very specific circumstances where demolition of the structure in contact with PCB contaminated soil/sediment is not practical.

Data Quantity

The location, number and type of analysis of post-excavation confirmatory soil/sediment samples to be analyzed from the excavation area will be determined based on a 20-ft grid as discussed in the previous section. The samples collected will be analyzed for PCBs, metals, VOCs, SVOCs, and cyanide in select areas.

As previously noted, the number of concrete and/or wipe samples is not quantified, as these sampling techniques will be infrequent in nature and will only be used in very specific circumstances where demolition of the structure in contact with PCB contaminated soil/sediment is not practical.

Sampling and Analysis Methods

The Field Sampling Plan contains a description of the post-excavation confirmatory, disposal characterization and additional miscellaneous sampling procedures to be employed during the RA. The recommended analytical methods and reporting limits are listed in Table 5-1 of this QAPP. The final analytical methods and reporting limits will be supplied by the selected analytical laboratory prior to commencing work.

Precision And Accuracy Quality Control Limits

Recommended precision and accuracy quality control limits for chemical constituents that are used during data review to assess analytical performance, are included in Tables 5-2 and 5-3. The selected laboratory will provide statistically derived in-house criteria for matrix spike recoveries and precision data, laboratory control sample recoveries and surrogate recoveries. The in-house control limits will be generated and evaluated in accordance with USEPA SW846 method 8000 or the applicable analytical method. These limits will be reviewed by LEA prior to commencing work to ensure that the limits are acceptable to meet the RA objectives. Data comparability will be achieved through the use of standard CTDEP/USEPA approved methods. Data completeness will be assessed at the conclusion of the RA.

5.1.5 Disposal Characterization Sampling

Data Uses

Disposal characterization sampling will be conducted to determine handling requirements for soil/sediment/concrete and non-porous materials and debris excavated during the RA.

Data Type

The disposal characterization sampling will include the collection of soil/sediment/concrete and non-porous materials samples. Sampling will be conducted on these materials in their in-situ condition for waste characterization as appropriate for soil/sediment and concrete and in their general as-found condition for non-porous materials (removal may be necessary for wipe sampling). Samples will be analyzed by a laboratory in accordance with the provisions of this plan. Immunoassay field testing may be used to supplement the laboratory data when segregating >50 ppm PCB remediation waste from < 50 ppm PCB remediation waste.

Data Quality

Laboratory analysis for PCBs and other constituents of concern will be performed in accordance with the methods referenced in USEPA SW 846. The results will be presented using a standard laboratory report format and final electronic deliverables. Field screening of soil/sediment samples may be performed using field test kits in accordance with SOPs provided by the manufacturer.

Data Quantity

Typically, one composite disposal characterization sample will be collected for every 500 CY of soil/sediment removed from a RA excavation area as directed by LEA. LEA may elect to perform disposal characterization sampling at an alternate frequency based on review of previous investigation data to aid in the evaluation of disposal options. QA/QC disposal characterization samples will not be submitted for laboratory analysis.

Sampling and Analytical Methods

The Field Sampling Plan presents a description of the disposal characterization soil/sediment/concrete and non-porous materials sampling procedures to be employed during the RA. The recommended laboratory methods to be utilized are presented on Table 5-1 of this QAPP. Final laboratory methods to be utilized will be provided by the selected analytical laboratory prior to commencing work.

Precision And Accuracy Quality Control Limits

Precision and accuracy quality control limits for chemical constituents analyzed as part of the characterization sampling will not undergo data review. Data comparability will be achieved through the use of standard CTDEP/USEPA approved methods. Data completeness will be assessed at the conclusion of the RA.

5.1.6 Miscellaneous Sampling

Data Uses

Miscellaneous sampling will be conducted to generate data to determine handling requirements for the following material, which will be generated during implementation of the RA:

- Effluent from the temporary wastewater treatment system; and
- Building components from demolition of the existing on-site process water facility.

Data Types

The miscellaneous sampling will include the collection and analysis of samples for laboratory analysis as described below:

- Surface water and/or groundwater which enters the active excavation area and water generated from soil/sediment dewatering activities (as applicable) will be pumped to an on-site temporary wastewater treatment system. Effluent samples from the temporary wastewater treatment system will be submitted for laboratory analysis, as described below, to confirm that limits for discharge to the local sanitary sewer system are achieved.
- In-situ samples (where physically practical) of the identified existing process water facility components in contact with PCB contaminated materials will be submitted for laboratory analysis to determine disposal requirements during the demolition process.

Data Quality

Sample analysis for miscellaneous samples will be conducted in accordance with USEPA standard methods. TPH analysis will be conducted by SW-846 Method 418.1

Data Quantity

The number of miscellaneous samples to be collected as part of the RA is presented below:

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- Samples of the effluent water from the temporary on-site wastewater treatment system will be submitted based upon the requirements of the discharge permit; and
- The number of samples from the demolition of the process water facility will be determined during the RA effort.

Sampling and Analytical Methods

Field instruments used during the program will be calibrated according to the schedule included as Table 5-4 to confirm appropriate analyses, as applicable. A summary of potential field equipment and calibration data is included in Table 5-4. Samples of building components will be submitted for laboratory analysis for PCBs, metals, VOCs, SVOCs, TPH, and other analytes as required by disposal vendors using EPA-approved methods. Samples of effluent from the temporary water treatment system will be analyzed for those parameters specified in the discharge authorization.

Precision And Accuracy Quality Control Limits

Precision and accuracy quality control limits will not be reviewed for miscellaneous samples submitted for laboratory analysis as part of the RA.

Data representativeness is addressed by the sample quantities and/or locations identified in the Field Sampling Plan. Data comparability will be achieved through the use of standard USEPA/CTDEP approved methods. Data completeness will be assessed at the conclusion of the RA.

5.2 Project Organization and Responsibilities

5.2.1 Project Organization

The RA will require integration of personnel from the organizations identified below, referred to as the project team. A detailed description of the responsibilities of each members of the project team is presented below.

5.2.2 Overall Project Management

LEA, on behalf of UTC/P&W, has overall responsibility for the RA at the site. LEA will perform the confirmatory soil/sediment/concrete and miscellaneous non-porous material sampling, disposal characterization sampling and miscellaneous sampling described in the Field Sampling Plan. In addition, LEA will be responsible for evaluating resultant sampling data and preparing required data submittals. UTC/P&W will provide project direction and oversight.

5.2.3 Team Member Responsibilities

This section of the QAPP discusses the responsibilities and duties of the project team members.

UTC/P&W

UTC/P&W Project Manager responsibilities and duties include:

- Overall direction of the RA;

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- Direction of LEA; and
- Review of LEA work products, including data, memoranda, letters, reports, and all documents transmitted to the USEPA and CTDEP.
- Assure corrective actions are taken for deficiencies cited during audits of sampling/analytical activities.

LEA

LEA's responsibilities and duties include:

- Oversight of remedial work activities and products; and
- Coordination with UTC/P&W, USEPA and CTDEP.

More specifically, LEA personnel will have the following responsibilities:

LEA Project Manager

Responsibilities and duties include:

- Management and coordination of all aspects of the project as defined in the RAWP with an emphasis on adhering to the objectives of the RA; and
- Coordination of office and field activities with P&W/UTC.

LEA Task Manager

Task Manager (Project Engineer/Geologist), as set forth in Section 5.2.3 will manage the ongoing sampling and analysis activities associated with the RA. Responsibilities and duties of each Task Manager include:

- Manage day to day remedial sampling activities;
- Develop, establish, and maintain files on remedial sampling activities;
- Review data from the remedial sampling activities;
- Assure corrective actions are taken for deficiencies cited during audits of remedial sampling activities;
- Overall QA/QC of the portions of the RA;
- Review all field records and logs;
- Instruct personnel working on remedial sampling activities;
- Coordinate field and laboratory schedules pertaining to remedial sampling activities;
- Ensure in coordination with the Quality Assurance Manager the preparation of QA/QC samples including performance evaluation samples;
- Request sample bottles from the laboratory;
- Review the field instrumentation, maintenance, and calibration to meet quality objectives;
- Prepare sections of reports pertaining to relevant RA; and
- Maintain field and laboratory files of field forms and logs, data reductions and calculations.

LEA Field Sampling Personnel

The field sampling personnel's responsibilities and duties include:

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- Prepare sample labels and field paperwork
- Perform field procedures associated with the collection of samples as set forth in the FSP;
- Perform field analyses and collect QA samples;
- Calibrate, operate, and maintain field instrumentation equipment;
- Reduce field data;
- Maintain sample custody; and
- Complete field records and logs and provide copies to the LEA Task Manager.

Quality Assurance Manager (QAM)

The QAM's responsibilities and duties include:

- Review laboratory data packages;
- Coordinate field QA/QC activities with task managers, included audits of sampling activities, concentrating on field analytical measurements and practices to meet data quality objectives;
- Review audit reports; and
- Prepare interim QA/QC compliance reports.
- The QAM will be independent of the unit generating the data.

An organizational chart specifically identifying these responsible parties is included in Appendix E.

5.2.4 Analytical Laboratory

Selected Analytical Laboratory

The selected analytical laboratory's general responsibilities and duties include:

- Perform sample analyses and associated laboratory QA/QC procedures;
- Supply sampling containers, shipping packages, and preservatives;
- Maintain laboratory custody of sample; and
- Strictly adhere to all protocols in the QAPP.

Laboratory Project Manager

The Laboratory Project Manager's responsibilities and duties include:

- Serve as primary communication contact between LEA and the laboratory technical staff;
- Monitor work loads and ensure availability of resources;
- Oversee preparation of analytical reports;
- Provide data validation packages as requested, and
- Supervise in house chain-of-custody.

Laboratory Quality Assurance Manager

The Laboratory QAM's responsibilities and duties include:

- Supervise the group which reviews and inspects all project related laboratory activities; and

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- Conduct audits of all laboratory activities.

Laboratory Sample Custodian

The Laboratory Sample Custodian's responsibilities and duties include:

- Receive all samples; and
- Maintain custody of the samples and all documentation.

Laboratory Data Reviewer

The Laboratory Data Reviewer's responsibilities and duties include:

- Verify final analytical data prior to transmittal to LEA.

5.3 Quality Assurance Objective for Measurement of Data

5.3.1 General

This section identifies the parameters that will be measured in the field and parameters that will be analyzed in the laboratory as part of the RA sampling. This section also identifies the quality assurance parameters objectives for field measurement/laboratory analysis.

5.3.2 Field Parameters and Methods

Selected soil/sediment samples collected during the RA may be screened using PCB field test kits.

5.3.4 Laboratory Parameters and Methods

As described in the Field Sampling Plan, laboratory analyses will be performed during the RA to determine concentrations of the following:

- PCBs, metals, VOCs, SVOCs, TPH, and cyanide in confirmatory soil/sediment/concrete and non-porous materials samples;
- PCBs, metals, VOCs, SVOCs, and cyanide in disposal characterization samples; Additional analyses may be performed to satisfy disposal vendor requirements.
- Specific analyses as required by the applicable permit(s) for samples of the effluent water from the temporary on-site wastewater treatment system; and
- Miscellaneous samples to be determined for disposal of demolition debris from the existing process water facility.

QA/QC analyses will be performed for analyses of PCBs, metals, VOCs, SVOCs, and cyanide as set forth on Table 4-4. Table 5-1 presents the recommended reporting limits for each of the analytes. The final reporting limits will be supplied by the selected laboratory prior to commencing work. The reporting limits will be at a concentration consistent with the appropriate criteria of the State of Connecticut Remedial Standard Regulations or lowest appropriate reporting limit for each compound, whichever is lower.

5.3.5 Measurement Performance Criteria

The overall quality assurance objective for the RA sampling and analysis program is to develop and implement procedures for sampling, preservation, chain-of-custody, laboratory analysis, instrument calibration, data reduction and reporting, internal quality control, audits, preventative maintenance, and corrective actions necessary to generate valid and technically defensible data. The measurement performance criteria will be communicated to the laboratory by the LEA Project Manager in order to ensure that the data users' quality objectives are linked to verifiable measurement performance criteria. These procedures are presented in the following sections of the QAPP. Specific QC checks are also discussed in the following sections.

Quality assurance objective are generally defined in terms of the following DQIs:

- Representativeness;
- Comparability;
- Completeness;
- Precision; and
- Accuracy.

Specific objectives relative to each of the DQIs for the RA sampling and analysis program are also set forth in other sections of this QAPP where applicable.

5.3.6 Representativeness

Representativeness is the degree to which sampling data accurately and precisely represents site conditions, and is dependent on sampling and the variability of environmental media at the site. The sampling program has been designed to assess the presence of the chemical constituents at the time of sampling. Representativeness may be measured through data collected for field duplicates, interlaboratory splits, field replicates, and previously analyzed samples. The FSP presents the rationale for sample quantities and location. The FSP and this QAPP presents field sampling methodologies and laboratory analytical methodologies, respectively. Data for confirmatory samples, which do not meet QC acceptance criteria as specified in Table 5-6 will be qualified accordingly and communicated to the end user. Documentation of such data will be presented in a written validation memorandum.

5.3.7 Comparability

Comparability is the degree of confidence with which one data set can be compared to another. Comparability throughout the RA will be maintained through consistent use of the sampling and analytical methodologies set forth in this QAPP and the FSP through the use of established QA/QC procedures, use of the data management system and the utilization of appropriately trained personnel. Data for confirmatory soil samples, which do not meet criteria as specified in the Tier II data validation guidelines, will be qualified accordingly and communicated to the end user.

5.3.8 Completeness

Completeness is defined as a measure of the amount of valid data obtained from an event compared to the total amount that was obtained. Percent completeness will be calculated for all confirmatory soil/sediment/concrete and non-porous materials sample data after Tier II validation is completed by comparing the ratio between the total number of rejected measurement points versus the total number of

measurements. This will be determined upon final assessment of the analytical results, as discussed in Section 5.11 of this QAPP.

5.3.9 Precision

Precision is a measure of the reproducibility of sample results. The goal is to maintain a level of analytical precision consistent with the objective of the SAP. To maximize precision, specific sampling and analytical procedures will be followed. All sampling and analysis work for this RA will adhere to the established protocols presented in the QAPP and Field Sampling Plan. Checks for analytical precision may include the analysis of matrix spike, matrix spike duplicates, laboratory duplicates and field duplicates. Checks for field measurement precision may include obtaining duplicate field measurements. Precision will be assessed during the Tier II data validation. Data will be qualified based on Tier II data validation criteria for the above mentioned QC samples. Data for confirmatory soil/sediment/concrete and non-porous materials samples which do not meet criteria as specified in the Tier II data validation guidelines will be qualified accordingly and communicated to the end user.

5.3.10 Accuracy

Accuracy is a measure of how close a measured result is to the true value. Both field and analytical accuracy will be monitored through initial and continuing calibration of instruments. In addition, interlaboratory split samples, reference standards, matrix spikes, blank spikes, laboratory spikes, laboratory control samples and surrogate standards may be used to assess the accuracy of the analytical data. Accuracy will be evaluated during the Tier II validation procedures. Laboratory control limits will be assessed and data will be qualified based on Tier II data validation criteria for the above mentioned parameters. All qualified data will be communicated to the end user.

5.4 Sampling Procedures

Post-excavation confirmatory soil/sediment/concrete and non-porous materials samples, disposal characterization samples and miscellaneous samples will be collected as described in the FSP. In the event of a variance in the field sampling procedures, a case narrative will be included in the field notes. The narrative will describe the nature of the variance in procedure, the reason for the variance, any effect the action may have on the data, and any corrective action taken. The LEA Project Manager will be notified immediately of any variance taken in field and/or laboratory procedures.

Sample containers and, in the case of wipe sampling, sampling materials will be ordered from the laboratory to ensure a sufficient number are in inventory at least 3 days prior to sampling. The number of containers will be in excess of the expected number of samples collected to prevent a shortage due to breakage. Chain-of-custody forms and custody seals (if necessary) will be kept in inventory in a similar manner.

5.5 Sample and Document Custody

5.5.1 General

This section identifies the field and laboratory procedures for the handling and documentation of samples collected as part of the RA. The field and laboratory sample handling and documentation procedures are presented below.

5.5.2 Field Procedures

The objective of field procedures for sample custody is to assure that samples are not tampered with from the time of sample collection through time of transport to the analytical laboratory. Persons will have “custody of samples” when the samples are in their physical possession, in their view after being in their possession, or in their physical possession and secured so the samples cannot be tampered with.

5.5.3 Laboratory Procedures

This subsection presents information related to laboratory sample custody, sample receipt and storage, sample analysis, laboratory documentation, and laboratory project files.

Sample Custody

Upon sample receipt, laboratory personnel will be responsible for sample custody. The original field chain-of custody form will accompany samples requiring laboratory analysis. Samples will be kept secured in the laboratory until all stages of analysis are complete.

Sample Receipt and Storage

Immediately upon sample receipt, the laboratory sample custodian will verify the package seal, open the package, and compare the contents against the field chain of custody and sign as recipient. If a sample container is received broken, the sample is in an inappropriate container, or has not been preserved by appropriate means, LEA will be notified. The laboratory sample custodian will be responsible for logging in the samples, assigning a unique laboratory identification number to each sample, labeling the sample bottle with the laboratory identification number, and moving the sample to an appropriate storage location to await analysis.

Sample Analysis

Analysis of an acceptable sample will be initiated by worksheets, which contain all pertinent information for analysis. The analyst will sign and date the laboratory chain of custody form when removing the samples from storage.

Samples will be organized into sample delivery groups (SDGs) by the laboratory. A SDG may contain up to 20 field samples (field duplicates, performance evaluation samples, trip blanks, and equipment blanks are considered field samples for the purposes SDG assignment). All field samples assigned to a single SDG shall be received by the laboratory over a maximum of five calendar days (less, when five-day holding times for extraction must be met), and must be processed through the laboratory (preparation, analysis and reporting) as a group. Every SDG will include a minimum of one site-specific matrix spike/matrix spike duplicate (MS/MSD or MS/Dup) pair, which shall be received by the laboratory as part of the SDG assignment.

Each SDG will be self-contained for all of the required quality control samples. All parameters within an SDG will be extracted and analyzed together in the laboratory. At no time will the laboratory be allowed to run any sample (including QC samples) at an earlier or later time than the rest of the SDG. These rules for analysis will ensure that the quality control samples for an SDG are applicable to the field samples of the same SDG, and that the best possible comparisons may be made.

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In case of a failure in the analytical system, the laboratory will be responsible for the necessary corrective action as described by the laboratory SOP or the analytical method. Any questionable laboratory data will be subjected to data validation as described in Region I, EPA-New England Data Validation Functional Guidelines For Evaluating Environmental Analyses, Rev. December 1996. As noted above, data validation packages will be requested for all confirmatory sampling data.

In the event of a variance in the laboratory analysis procedures, a case narrative will be included in the laboratory data package. The narrative will describe the nature of the variance in procedure, the reason for the variance, any effect the action may have on the data, and any corrective action taken. The LEA Project Manager will be notified immediately of any variance taken in field and/or laboratory procedures.

Laboratory Project Files

The laboratory will establish a file for all pertinent analytical data generated during the RA. The file will include the chain of custody forms, raw data, chromatograms (required for all constituents analyzed by chromatography), and sample preparation information. The laboratory will retain all project files and data packages for a period of five years.

Laboratory Documentation

Workbooks, bench sheets, instrument logbooks, and instrument printouts are used to trace the history of the samples through the analytical process, and document and relate important aspects of the work, including the associated quality controls. As such, all logbooks, bench sheets, instrument logs, and instrument printouts are part of the permanent record of the laboratory.

Each page or entry is dated and initialed by the analyst at the time of entry. Errors in entry are crossed out in indelible ink with a single stroke, corrected without the use of whiteout or by writing directly over the erroneous entry, and initialed and dated by the individual making the correction.

Laboratory notebooks are periodically reviewed by the laboratory group leaders for accuracy, completeness, and compliance to this QAPP.

Computer and Hard Copy Storage

Gas Chromatograph/Mass Spectrometry (GC/MS) raw data files are maintained on computer disk for five years, hard copy GC chromatograms are maintained in files for a minimum of five years, or as dictated by the policy of the selected laboratory.

Sample Storage Following Analysis

The laboratory maintains samples for a minimum of one month after the final report is delivered to LEA, or for a duration equal to the sample holding time. After this period, the samples shall be transferred to P&W/UTC for disposal in accordance with applicable rules and regulations.

5.6 Calibration Procedures and Frequency

5.6.1 Field Equipment Maintenance and Calibration Procedures and Frequency

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Any field equipment will be thoroughly inspected on a daily basis. Any equipment deficiencies will be noted and remedied prior to leaving for the site. Any equipment found not in good working order will be repaired or replaced as necessary. No equipment shall return to field use unless found to be in good working order after repair. The LEA Equipment Manager will be responsible for assuring replacement equipment is available in case of equipment malfunction. In the event of equipment malfunction, replacement equipment in good working order will be transported to the site.

Any critical spare parts for field equipment will be in stock prior to the start of the project. After the project begins, the inventory of spare parts will be replenished as needed by the Equipment Manager. Specific procedures for performing and documenting calibration and maintenance for the field equipment for total organic vapors are provided in the FSP. Field equipment, frequency of calibration, and calibration standards are provided in Table 5-4. Maintenance will be performed according to the instrument instruction manual.

Calibration standards for the pH meter, conductivity meter, and turbidity meter are purchased as solutions certified by the manufacturer.

5.6.2 Laboratory Equipment Calibration Procedures and Frequency

Instrumentation calibration will follow the specifications provided by the SOPs for the analytical methods used as outlined in USEPA SW846.

5.7 Analytical Procedures

5.7.1 Field Analytical Procedures

Field analytical procedures may include field screening for PCBs using a field test kits. Specific field measurement quality in terms of precision and accuracy are presented in Table 5-5.

5.7.2 Laboratory Analytical Procedures

Specific requirements related to each sample medium to be analyzed and details of the methods to be used for this project are presented in the subsections below. The methods to be include the following:

- Standard USEPA methods will be used for the laboratory analysis of PCB's and the required analyses for the RA material disposal and permit requirements.
- CTDEP approved methods and updates will be used for laboratory analysis where applicable.

The anticipated turnaround times for receipt of analytical results for samples are summarized in the table below.

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Sample Type	Turnaround Time
Post-excavation soil/sediment/concrete and non-porous material samples	24 hours to 2 weeks
Disposal characterization samples	24 hours to 2 weeks
Effluent samples from wastewater treatment system	24 hours to 2 weeks
Water treatment building demolition	1 week to 2 weeks

5.7.3 General Analytical Requirements

The number of soil/sediment and QC samples to be analyzed are summarized in Tables 4-1 and 4-2. The analytical parameters, recommended methods and recommended reporting limits are presented in Table 5-1. Final methods and reporting limits will be provided by the analytical laboratory prior to commencing work.

5.7.4 Remedial Action Sample Matrices

Soil/Sediment/Concrete, and Solids

Soil/sediment/concrete and solids analytical results will be determined on a dry weight analysis as specified in the appropriate sample extraction method. The results will be reported in the units presented in Table 5-1. Moisture content will be reported separately. Recommended QC limits for soil/sediment/concrete samples to be analyzed for PCBs, metals, VOCs, SVOCs and cyanide (at select locations) are presented in Table 5-2. The final limits will be established using the selected analytical laboratory's internal control limits.

Wipe Samples of Non-porous Materials

Wipe samples from non-porous materials will be analyzed as appropriate for compliance demonstration. The results will be reported in the units presented in Table 5-1. Recommended QC limits for wipe samples to be analyzed for PCBs are presented in Table 5-2.

Water

Water from the temporary wastewater treatment system is included in this category and will be analyzed as necessary for compliance monitoring. Analytical results for the water analysis will be reported in the units identified in Table 5-1.

Analytical Requirements

The primary sources for methods used to analyze soil/sediment/concrete and non-porous materials are provided in the USEPA documents. LEA will assess data usability of PCBs. The primary sources for methods used to analyze water samples associated with the on-site temporary wastewater treatment system are provided in 40 CFR 136.

Tables summarizing QC limits required to evaluate analytical performance are provided as follows:

Table	Title
5-2	Soil Analysis Quality Control Limits
5-3	Water Analyses Quality Control Limits

5.8 Data Reduction, Review, and Reporting

After field and laboratory data are obtained, the data will be subject to the following:

- Reduction or manipulation mathematically or otherwise into meaningful and useful forms;
- Review;
- Organization, interpretation, and reporting; and
- External data review.

The subsections below present descriptions of the data reduction, review, and reporting activities that will be conducted in the field and laboratory as part of the RA sampling and analysis program.

5.8.1 Field Data Reduction

Information collected in the field through visual observation, manual measurement and/or field instrumentation will be recorded in field forms. The LEA Task Manager will review such data for adherence to the FSP and for consistency. Concerns identified as a result of this review will be discussed with the field personnel, corrected if possible, and as necessary, incorporated into the data evaluation process. Data reduction will be performed for the confirmatory soil/sediment/concrete and non-porous material sampling and the disposal characterization soil sampling associated with determining PCB concentrations using a field test kits.

5.8.2 Field Data Review

Field data calculations, transfers, and interpretations will be conducted by field personnel and reviewed for accuracy by the LEA Task Manager and the QAM. All logs and documents will be checked for:

- General Completeness;
- Readability;
- Usage of appropriate procedures;
- Appropriate instrument calibration and maintenance;
- Reasonableness in comparison to present and past data collected;
- Correct sample locations; and
- Corrected calculations and interpretations.

5.8.3 Laboratory Data Reduction

The calculations used for data reduction are specified in each of the analytical methods referenced previously. Whenever possible, analytical data is transferred directly from the instrument to a computerized data system. Raw data is entered into permanently bound laboratory notebooks. The data entered are sufficient to document all factors used to arrive at the reported value.

Concentration calculations for chromatographic analyses (as for example, PCBs, VOCs) are based on response factors. Quantitation is performed using internal or external standards.

5.8.4 Laboratory Data Review

All data will be subject to review by the laboratory. The analyst will review the data and enter it into the computer. The department manager will review the data and send it to the LIMS to be printed. The project manager will perform a final review of the final reports. The laboratory director will perform a final review prior to releasing data. If discrepancies exist in the analytical results, then corrective action is taken as discussed in Section 5.11.

5.8.5 Laboratory Data Reporting

The laboratory is responsible for preparing standard laboratory reports for all samples analyzed. Data will be tabulated by sample and method, with reference to both field and laboratory identifications. In addition, the laboratory will provide documentation backup (laboratory calculation sheets, chain of custody, etc.)

5.9 Field and Laboratory Quality Control Checks

5.9.1 General

Both field and laboratory quality control checks will be implemented during the RA. If a failure in the established sampling protocol occurs before the sample is collected, the field personnel shall use professional judgment to determine the location of an appropriate replacement sample. This alternative sample location will be documented in the field forms, and the information as to the reason for and location of the alternative sampling will be reported to the LEA Project Manager or designated person. If a failure in the established sampling protocol occurs after sample submission (for example, if part of the complete sample set is found to be inadmissible), the Project Manager will determine the location of replacement samples and collection methodology. The proposed field and laboratory control checks are discussed below.

5.9.2 Field Quality

Field quality control checks will include obtaining duplicate field measurements, using analyte-free water for the preparation of sample blanks, using clean sample containers, collecting duplicate samples, and preparing rinse blanks, as further described in the subsections below.

5.9.3 Field Measurements

To verify the quality of data using field instrumentation, duplicate measurements will be obtained and reported for all field measurements.

5.9.4 Sample Containers

Certified-clean sample containers will be supplied by analytical laboratory. Certificates of analysis will be filed in the project file.

5.9.5 Field Duplicates

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Field duplicates will be collected for soil/sediment/concrete and non-porous material samples to verify the reproducibility of the sampling methods. Field duplicates will be prepared as discussed in the FSP. In general, soil/sediment/concrete and non-porous material sample field duplicates will be analyzed at a frequency of one every 20 samples for chemical constituents. Table 4-4 provides an estimated number of field duplicates to be prepared for each applicable parameter and matrix (excluding concrete and wipe samples). Acceptable field duplicate precision for soil samples will have an RPD of less than 50%. Data that do not meet the criteria will be qualified according to USEPA Region I, Data Validation Guidelines, revised December 1996.

5.9.6 Equipment Blanks

Equipment blanks are used to monitor the cleanliness of sampling equipment and the effectiveness of the decontamination procedures. Equipment blanks will be prepared and submitted for analysis at a frequency of one every 20 samples. Equipment blanks will be prepared by filling sample containers with analyte free water, which has been routed through a cleaned sampling device. If dedicated sampling devices are used or sample containers are used to collect the samples, rinse blanks will not be required. Table 4-4 provides the estimated number of equipment blanks for environmental samples to be collected excluding concrete and wipe samples. Equipment blanks for wipe sample techniques will be collected by wiping the surface of a disposable template with a hexane soaked gauze pad then analyzing the pad.

The criterion for equipment blanks is such that no target compound should be present at or above the laboratory quantitation limit. Data that do not meet the criteria will be qualified using the 5X action rule according to USEPA Region I Data Validation Guidelines, Revisions December 1996.

5.9.7 Method Blanks

Sources of contamination in the analytical process, whether specific analytes or interferences, need to be identified, isolated, and corrected. The method blank is useful in identifying possible sources of contamination within the analytical process. For this reason, it is necessary that the method blank is initiated at the beginning of the analytical process and encompasses all aspects of the analytical work. As such, the method blank would assist in accounting for potential contamination attributable to glassware, reagents, instrumentation, or other sources, which could affect the sample analysis. One method blank will be analyzed with each analytical series associated with no more than 20 samples. The criterion for method blanks is such that no target compound should be present at or above the laboratory quantitation limit. Data that do not meet the criteria will be qualified using the 5X action rule (10X rule for common laboratory contaminants) according to USEPA Region I Data Validation Guidelines, Revisions December 1996.

5.9.8 Matrix Spike/Matrix Spike Duplicates

MS/MSD will be used to measure the accuracy and precision of organic analyte recovery from sample matrices. All MS/MSD will be site specific. For PCBs, metals, VOCs, SVOCs, and cyanide matrix spike/matrix spike duplicate pairs will be analyzed at a frequency of one every 20 samples.

The percent recovery (%R) and the relative percent difference (RPD) will be evaluated for MS/MSD data and compared with the acceptance criteria as stated in the appropriate EPA analytical method. When MS recoveries and RPDs are outside QC limits, associated MS blank and surrogate recoveries will be evaluated to attempt to verify the reason for deviation and determine the effects on the reported sample results. In addition, the percent relative standard deviation (%RSD) will be calculated for the unspiked

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sample, the MS and the MSD and will be considered a triplicate in determining overall precision of the analytical method. The unspiked sample results will be qualified according to the USEPA Region I Data Validation Guidelines, Revisions December 1996 for any data that is outside acceptable control limits. Table 4-4 presents the estimated number of MS/MSD analyses for each applicable matrix and parameter.

5.9.9 Surrogates

Surrogates are compounds, which are unlikely to occur under natural conditions that have properties similar to the analytes of interest. This type of control is primarily used for organic samples analyzed by GC/MS and GC methods and is added to the sample prior to extraction. The surrogate spike is utilized to provide broader insight into the proficiency and efficiency of an analytical method on a spike specific basis.

If surrogate recoveries exceed specified QC limits, then the analytical results need to be evaluated thoroughly in conjunction with other control measures. Recoveries for surrogate compounds in samples, QC samples and blanks must be within the QC acceptance criteria as specified in the appropriate EPA analytical method. Samples with surrogate compounds outside acceptance will be qualified according to USEPA Region I Data Validation Guidelines, Revisions December 1996. Surrogate compounds will be selected utilizing the guidance provided in the analytical methods summarized in Table 5-2.

5.9.10 Calibration Standards

Compliance requirements for initial calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data. Calibration check standards will be analyzed as specified in the applicable analytical method. In analyses where internal standards are used, a calibration check standard will only be analyzed in the beginning of an analytical series. If the results of the calibration check standard exceeds specified tolerances, then all samples analyzed since the last acceptable calibration check standard will be re-analyzed.

Laboratory instrument calibration standards will be selected utilizing the guidance provided in the recommended analytical methods summarized in Table 5-1 or other appropriate method defined prior to commencing work. Calibration data will be evaluated based on USEPA Region I Data Validation Guidelines, Revisions December 1996. Data that does not meet acceptance criteria will be qualified accordingly.

5.9.11 Internal Standards

Instrument performance, stability and laboratory precision throughout an analytical sequence is monitored by the addition of internal standard compounds. Internal standard areas and retention times are monitored for organic analysis performed by GC/MS methods. Method specific internal standard compounds are spiked into all field samples, calibration standards and QC samples after preparation and prior to analysis. If the internal standard areas in one or more samples exceed the specified tolerances, then the instrument will be recalibrated and all affected samples reanalyzed.

The acceptability of internal standard performance will be determined using the guidance provided within the analytical methods summarized in Table 5-1 and other methods deemed appropriate by the selected analytical laboratory prior to commencing work. Sample results with internal standard areas and/or

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retention time data outside control limits will be qualified based on USEPA Region I Data Validation Guidelines, Revisions December 1996

5.9.12 Reference Standards

Reference standards are standards of known concentration, and independent in origin from the calibration standards. Reference standards, are generally available through the USEPA, the National Bureau of Standards, or are specified in analytical methods. The intent of reference standard analysis is to provide insight into the analytical proficiency within an analytical series.

5.9.13 Performance Evaluation Program

Performance Evaluation Audit

Data for performance evaluation samples will be generated to provide information on the overall accuracy and bias of the analytical method and on laboratory performance. UTC/P&W will conduct a performance evaluation (PE) audit as part of the program following "USEPA Region I Performance Evaluation Program Guidance," July 1996 Revision. Based upon the criteria presented in Attachment H of the USEPA Region 1 PE program guidance document, only aqueous PE samples will be submitted for this program. An overview of the proposed PE audit program is as follows:

- LEA will coordinate PE sample acquisition with the selected vendor prior to initiating the RA program;
- Sample acquisition, handling, and analyses will be in general accordance with USEPA Region 1 guidance criteria; and
- It is estimated that a total of four PE aqueous samples will be submitted as part of the program.

All samples in a sample delivery group will be validated based upon a comparison between the vendor-certified performance evaluation (PE) results and the laboratory's reported results. PE samples will be evaluated for false negatives, false positives, and inaccurate target compound quantitation. The PE samples provide information on the magnitude and direction of quantitative bias for the laboratory method. Results that are outside the vendor-certified acceptance limits will be qualified according to USEPA Region I Data Validation Guidelines, Revisions December 1996.

5.10 Performance and System Audits

5.10.1 General

This section describes the performance and system audits that will be completed in the field and the laboratory during implementation of RA.

5.10.2 Audits

Field performance and systems audits that will be completed during this project are described in the subsection below. The results of all audits and reviews, along with recommendations for corrective action, will be given to the LEA Project Manager as soon as possible in order to assess the need for any corrective action.

Readiness Reviews

Readiness reviews will be conducted prior to commencing each phase of the project on an as-needed basis to ensure all components required for each phase are in place.

Surveillance

Surveillance of remedial activities will be conducted by the LEA Task Manager or other field personnel on-site on a daily basis. Activities should be documented in the field notes. Any deviations from the FSP or QAPP should be reported to the Project Manager as soon as possible.

Technical System Audit

A Technical System Audit (TSA) shall be performed by the LEA Project Manager or person designated by the Project Manager shortly after commencing remedial activities. The purpose of the TSA is to ensure that facilities, personnel, training, procedures and record keeping are in accordance with the QAPP. Performing this early in the project provides opportunity for corrective action.

Audit of Data Quality

An audit of data quality will be performed by the management team prior to final reporting. This will serve to reveal how the data were handled, what judgments were made, and whether uncorrected mistakes were made.

5.10.3 Performance Audits

The LEA Task Manager will monitor field performance. Field performance audit summaries will contain an evaluation of field measurements and field meter calibration to verify that measurements are taken according to established protocols. The QAM will review all field reports and communicate concerns to the Project Manager and/or Task Managers.

5.10.4 Internal System Audits

A field internal system audit is a qualitative evaluation of all components of field QA/QC. The system audit compares scheduled QA/QC activities from this document with actual QA/QC activities completed.

5.10.5 Laboratory Audits

The analytical laboratory will perform internal audits consistent with applicable regulations. LEA reserves the right to conduct an on site audit of the laboratory prior to start of analyses for the project.

5.11 Data Assessment Procedures

The analytical data generated during the RA will be evaluated with respect to precision, accuracy, and completeness and compared to the data quality objectives set forth in this QAPP. A summary of recommended QC limits required to evaluate analytical performance is provided in Tables 5-2 and 5-3. Final QC limits will be established using the selected analytical laboratory's internal control limits.

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Following the collection of field sampling and analytical data, various statistical analyses can be performed to determine the data usability and sensitivity of the data.

Data usability can be checked through standard data validation procedures, and statistical cross validation procedures. These procedures involve predicting a data value for one point, based on results from other points. The difference between the measured and predicted number can indicate an invalid result.

An assessment of data sufficiency involves the determination of whether the confidence intervals values are rigorous enough to satisfy regulatory or engineering requirements.

5.11.1 Data Precision Assessment Procedures

Field precision will be controlled through the use of experienced field personnel, properly calibrated instruments, and duplicate field measurements. Field duplicates will be used to assess precision for the entire measurement system, including sampling, handling, shipping, storage, preparation, and analysis.

Laboratory data precision analyses will be monitored through the use of matrix spike/matrix spike duplicate sample analyses and performance evaluation samples. The precision of data will be measured by calculation of the relative percent difference (RPD) by the following equation:

$$RPD = \frac{(A-B)}{A+B/2} \times 100$$

Where:

A = Analytical results from first duplicate measurement

B = Analytical results from second duplicate measurement.

5.11.2 Data Accuracy Assessment Procedures

The accuracy of field precision will be controlled by experienced field personnel, properly calibrated field instruments, and adherence to established protocols. The accuracy of field instruments will be assessed by review of calibration and maintenance logs.

Laboratory accuracy will be assessed via the use of matrix spike, surrogate spikes, PE samples, and reference standards. Where available and appropriate, QA performance standards will be analyzed periodically to assess laboratory accuracy. Accuracy will be calculated in terms of percent recovery as follows:

$$\text{Percent Recovery} = \frac{(A-X)}{B} \times 100$$

Where:

A = Value measured in spiked sample

X = Value measured in original sample

B = True value of amount added to sample or true value of standard.

This formula is derived under the assumption of constant accuracy between the original and spiked measurements. Recommended accuracy objectives for matrix spike recoveries are found in Tables 5-2 and 5-3. Final accuracy objectives for matrix spike recoveries will be determined by the selected analytical laboratory's internal control limits.

5.11.3 Data Completeness Assessment Procedures

Completeness of field or laboratory data set will be calculated by comparing the number of valid sample results generated to the total number of results generated:

$$\text{Completeness} = \frac{\text{Number of Valid Results}}{\text{Total Number of Results Generated}} \times 100$$

As a general guideline, overall project completeness is expected to be at least 90%. The assessment of completeness will require professional judgment to determine data usability for intended purposes.

5.11.4 Internal Reporting

The QAM will review analytical concerns identified by the data review with the laboratory. Supporting data (i.e. historic data, related field or laboratory data) will be reviewed to assist in determining data quality, as appropriate. The QAM will incorporate results of assessments of data usability into a summary that will be submitted to the Project Manager and appropriate Task Managers.

5.11.5 RA Reporting

The summary report prepared by LEA will contain a QA/QC section summarizing the quality of data collected and/or used as appropriate to the project data quality objectives, which are discussed in this QAPP. The QAM will prepare the QA/QC summaries using reporting and memoranda documenting the data assessment and review.

5.11.6 Data Validation

A standardized data validation review process for judging the analytical quality and usefulness of data will be performed in accordance with the procedures set forth in the most current editions of the USEPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Environmental Analyses. Technical judgment on the validity of the laboratory results will be provided to determine the overall usability and legal defensibility. All confirmatory sample data obtained will be validated. Individual sample results will be accepted, rejected, or qualified. Validation decisions will be communicated to the end-user through a written data validation memorandum and all qualifiers applied to the individual sample results will be incorporated into the analytical database.

The following items will be reviewed when applicable:

- Data Completeness;
- Custody Documentation;
- Preservation and Holding Times;
- Instrument Performance;
- Initial and Continuing Calibration;
- Blanks;

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- Field Duplicate Precision;
- Surrogate Compounds and Recoveries;
- Internal Standard Compounds, Recoveries and Retention Times;
- Matrix Spike Recoveries/Duplicate Correlations;
- Control Spike/Laboratory Control Spike;
- Performance Evaluation Assessment;
- Instrument Detection Limits (IDLs);
- ICP Interference Check Sample;
- Furnace Atomic Absorption Analysis;
- ICP Serial Dilution;
- Method Compliance; and
- Sample Result Verification.
- Overall Evaluation of Data

Project requirements are for full Tier II validation of 100% of the confirmatory field samples within each data package.

5.12 Reports to Management.

Daily reports on remedial activities (verbal or written) will be given from field personnel to the LEA Project Manager or person designated by the Project Manager.

Laboratory reports will be given to the Project Manager as received.

Memorandums regarding data validation will be provided to the Project Manager after complete review of the laboratory data package by the data validation staff.

Attachment No. 2

Standard Operating Procedures

SOP ID 10001 Concrete Chip Sampling

SOP ID 10058W Wipe Sampling

**Standard Operating Procedure
For
Wipe Sampling**

**Willow Brook and Willow Brook Pond
PCB Remediation**

**SOP ID: 10058W
Date Initiated: 12/15/01**

Approved By:



Neil P. Hickey
Engineer

12/17/01
Date



George F. Andrews
Senior Project Manager

12/17/01
Date



REVISION RECORD

<u>Rev #</u>	<u>Date</u>	<u>Additions/Deletions/Modifications</u>
Initial Issue	12/15/01	



LOUREIRO ENGINEERING ASSOCIATES

Standard Operating Procedure For Wipe Sampling

1. Purpose and Scope

This SOP describes the procedures to be followed in collecting wipe samples. Wipe sample locations can be determined either on a random or biased basis. Wipe samples can be collected for analysis of volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), metals, and cyanide.

2. Definitions

- 2.1. Biased sample: A sample location chosen subjectively based on available information.
- 2.2. Random sample: A representative sample location chosen using the theory of random chance probabilities.

3. Equipment

Equipment that is required for collecting wipe samples shall include the following:

- Disposable wipe templates (thin (<3 mm) plastic or cardboard, able to lie flat)
- Tape for securing template to surface
- Tongs (Stainless steel for VOCs, PCBs, SVOCs; Teflon® for metals, cyanide)
- Cotton gauze pads (e.g., 2-inch square sterile pads)
- Sample containers (4-ounce jar with Teflon® seal)
- Pipettes (wrapped in aluminum foil)
- Appropriate solvent for sample collection (small bottle from lab)
 - methanol for VOCs
 - hexane for SVOCs or PCBs
 - dilute nitric acid (1:4 nitric acid to deionized water) for metals
 - dilute sodium hydroxide solution for cyanide
- PPE (appropriate gloves, safety glasses)
- Trash bag
- Measuring tape (100 foot)
- Cooler and ice/ice packs
- Labels and tape to cover labels



4. Procedure

- 4.1. Secure a clean 10-cm x 10-cm template cutout over the area to be sampled. Do not touch or walk on the marked area.
- 4.2. Remove a gauze pad from the package using decontaminated tongs of appropriate material. Be sure to use a new pair of gloves.
- 4.3. Soak the gauze in the appropriate solvent.
- 4.4. Using the tongs, wipe the area framed by the template with the moistened gauze in one direction.
- 4.5. Without allowing the gauze to contact any other surface, fold the gauze with the exposed side in, and fold again to make a 90-degree angle in the center of the gauze.
- 4.6. Place the gauze in the sample container, angle first. Replace and secure cap.
- 4.7. Label sample container with the appropriate label. Complete label properly with sample date and time.
- 4.8. Place the sample container in a cooler with ice/ice packs.
- 4.9. Complete chain-of-custody documents and record information in field forms and logbook, if applicable.
- 4.10. Document the sample location in the appropriate field forms and in field logbook, if applicable. Include a drawing or dimensioned sketch of the site.
- 4.11. Dispose of generated waste material properly.

Note: A separate gauze pad and newly selected sampling location should be used for each analyte listed above (i.e. VOCs, SVOCs, PCBs, metals, or cyanide). Do not sample the same area for more than one suite of analyses.

5. Quality Assurance/Quality Control (QA/QC)

Wipe equipment blanks shall be collected as appropriate based on the site specific work plan as follows:

- One equipment blank shall be collected by placing hexane on the wipe gauze and then wiping the surface of a disposable template.



Duplicate samples shall be collected by wiping a surface area adjacent to the original sample location using the procedure identified in section 4. Trip blanks are only used for sampling for VOCs.

6. References

U.S. Army Corps of Engineers, *Requirements For The Preparation Of Sampling And Analysis Plans*, Engineering Manual 200-1-3, Feb.1, 2001.


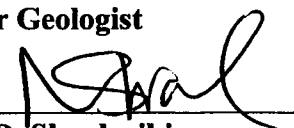


Loureiro Engineering Associates, Inc.
Standard Operating Procedure
for
Concrete Chip Sampling

SOP ID: 10001

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Approved By:		<u>12/20/01</u>
	David Lehnus	Date
	Senior Geologist	
		<u>12/19/01</u>
	Nick D. Skoularikis	Date
	Director of Quality	

REVISION RECORD

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Initial Issue	02/20/94	
001-003	-	No Record
004	07/10/00	Update LEA SOP in accordance with standard procedures outlined in SOP 10000, including logo. Added notes to Sections 8 and 9.
005	8/20/01	Updated to conform with new SOP format.



Loureiro Engineering Associates, Inc.
Standard Operating Procedure
for
Concrete Chip Sampling

1. Purpose and Scope

This document discusses procedures for collecting concrete chip samples for analysis. The procedures outlined in this document have been developed to produce reproducible results. Associated standard operating procedures (SOPs) that should be consulted include the Loureiro Engineering Associates (LEA) *SOP for Quality Assurance/Quality Control Measures for Field Activities* and *SOP for Soil Sampling*.

2. Definitions

2.1. Concrete chip sample: Concrete sample taken no deeper than 2 inches from surface to be sampled. The LEA Information Management System (LEAIMS) sample class used for concrete chip samples is "CC".

3. Equipment

3.1. Equipment required for sampling of concrete shall include:

- 3.1.1. Dixon lumber crayon or equivalent.
- 3.1.2. 100 foot tape.
- 3.1.3. Three decontamination wash buckets.
- 3.1.4. Sample collection bottles and labels.
- 3.1.5. Sample forms.
- 3.1.6. Clean disposable gloves.
- 3.1.7. Personal protective equipment.
- 3.1.8. Cooler, cold packs and maximum/minimum thermometer.



- 3.1.9. Alconox®/Liquinox® detergent, 10 percent methanol solution in water (v:v), 10 percent nitric acid solution in water (v:v), hexane, distilled water.
- 3.1.10. Brushes.
- 3.1.11. Spatulas.
- 3.1.12. Indelible marker.
- 3.1.13. Distilled water.
- 3.1.14. Hand towels.
- 3.1.15. Impact drill with stone chisel.
- 3.1.16. Nail punch.
- 3.1.17. Clear polyethylene plastic sheeting.
- 3.1.18. Three pound hammer.
- 3.1.19. Fifty-foot electrical extension cord.
- 3.1.20. One-inch adjustable crescent wrench.
- 3.1.21. Lined 55 gallon drums.
- 3.1.22. Ohaus weighing scale or equivalent.
- 3.1.23. Non-shrinking concrete.
- 3.1.24. Portable Volatile Organic Compound (VOC) Analyzer (Photovac MicroTip, Foxboro OVA, or equivalent)

4. Procedure

4.1. Sample Location

The location selection will be based on project-specific requirements. A grid pattern may be used (random sampling) or an inspection of the concrete surface will be performed to determine the location of cracks or discoloration on the concrete (judgmental sampling). In certain projects both random and judgmental samples are being collected. If a grid is being used, the location of each node of the grid pattern shall be determined and marked.



4.2. Sample Collection

Prior to sample collection, all sample bottles will be labeled using indelible ink with the following information: Sample number, date, area location, collector of sample.

- 4.2.1. Personal protection during all concrete chip sampling shall be at a minimum level D (unless a more stringent level is required by site-specific conditions), including but not limited to eye protection, work boots, and gloves. Full-face respirators, Tyvek® overalls and rubber gloves will be available on-site for use if deemed necessary by the field supervisor or sampling personnel.
- 4.2.2. The collection of concrete samples shall be in accordance with the following procedures:
 - 4.2.2.1. An impact drill equipped with a stone chisel shall be inserted through the center of a five-foot square section of plastic sheeting (to limit the dispersion of dust during sample collection). If sidewall samples are collected, a five-foot square section of plastic will be placed on the floor at the base of the wall.
 - 4.2.2.2. Samples shall be obtained by chipping of the concrete surface to a maximum depth of two inches, collecting a minimum of 400 grams of sample.
 - 4.2.2.3. Samples shall be placed into the appropriate pre-labeled sample bottle, the time of collection noted on the label, and the sample bottle placed into a cooler.
 - 4.2.2.4. All pertinent sampling data forms and chain of custody forms shall be completed.
 - 4.2.2.5. All sampling equipment shall be decontaminated in accordance with Equipment Decontamination Procedures (Section 4.3) and the plastic sheeting discarded into a lined 55-gallon drum for disposal.
 - 4.2.2.6. Steps 4.2.2.1 – 4.2.2.5 shall be repeated for each concrete sample to be collected.



- 4.2.3. Collection of field generated quality assurance/quality control (QA/QC) samples shall adhere to all applicable procedures noted in *SOP for Quality Assurance/Quality Control Measures for Field Activities* and should include the following procedures:
- 4.2.3.1. Field blanks/equipment blanks should be collected for each sample bottle/preservation technique/analysis procedure at the rate of one per day.
 - 4.2.3.2. Field duplicates/replicate samples (or collected samples for volatile organic compounds) should be obtained for each sample bottle/preservation technique/analysis procedure at the rate of one per sampling event or one for every 20 samples.
 - 4.2.3.3. Trip blanks for volatile organic compound analysis shall be collected at the rate of one per day or one per twenty samples collected.
- 4.2.4. Upon completion of each day, a field data collection quality review checklist shall be completed, as noted in the *Standard Operating Procedure for Quality Assurance/Quality Control Measures for Field Activities* (SOP # 10005).

4.3. Equipment Decontamination Procedures

- 4.3.1. All sampling equipment shall be decontaminated before each sample collection.
- 4.3.2. Decontamination of the sampling equipment shall adhere to the following procedures:
 - 4.3.2.1. All excess loose concrete and debris shall be removed from the sampling equipment and placed into the 55-gallon drum.
 - 4.3.2.2. Sampling equipment shall then be immersed in an Alconox®/Liquinox® and tap water solution and scrubbed to remove all debris.
 - 4.3.2.3. The order of decontamination solutions is as follows:
 1. Detergent scrub.
 2. Deionized (DI) water rinse.
 3. Hexane rinse.



4. DI water rinse.
5. 10 percent nitric acid rinse.
6. DI water rinse.
7. 10 percent methanol rinse.
8. Air dry.

4.3.3. An alternative to the procedure described above requires that the equipment be cleaned using a high-pressure wash and steam cleaning. Alternative methods of cleaning may be more appropriate for an individual piece of equipment for site conditions based upon knowledge of site contaminants, and may be used at the discretion of the LEA representative.

4.3.4. At the end of the project day, all used equipment shall be decontaminated. Dispose of all spent decontamination solutions in accordance with all applicable municipal, state and federal regulations.

4.4. Field Documentation

4.4.1. The following general information shall be recorded in the field forms:

- Site identification, LEA commission number.
- Site location.
- Name of recorder.
- Identification of concrete chip sample name and location (include sketch; concrete chip sample class is "CC").
- Collection method.
- Date and time of collection.
- Types of sample containers used, sample identification numbers and QA/QC sample identification.
- Preservative(s) used.
- Parameters requested for analysis.
- Field analysis method(s).
- Field observations during sampling event.
- Name of collector.
- Climatic conditions including ambient temperature.
- Internal temperature of field and shipping (iced) containers.
- Chronological events of the day.
- QA/QC data.
- A complete sample description (e.g. visual observations, discoloration, etc.).



4.4.2. The following information shall be recorded on the Field Quality Review Checklist:

- Reviewers name, date, and LEA commission number.
- Review of all necessary site activities and field forms.
- Statement of corrective actions for deficiencies.

4.4.3. The following information shall be recorded on the chain of custody record:

- Client's name and location.
- Date and time of collection.
- Sample number.
- Container type, number, size.
- Preservative used.
- Signature of collector.
- Signatures of persons involved in the chain of possession.
- Analyses to be performed.

4.4.4. The following information shall be provided on the sample label using an indelible pen:

- Sample identification number.
- Name of collector.
- Date and time of collection.
- Place of collection.
- Parameter(s) requested (if space permits).

4.4.5. The following information shall be recorded on the sample collection data sheet:

- Client name, location and LEA commission number.
- Date and time of collection.
- Sample number.
- Depth sample was obtained, as applicable.
- VOC reading.

5. Quality Assurance/Quality Control

5.1. All procedures documented in this SOP should be conducted to ensure quality and in accordance with LEA's *SOP for Quality Assurance/Quality Control Measures for Field Activities* (SOP ID 10005)



6. References

Other sampling procedures which may be pertinent to concrete chip sampling may be found in LEA SOP 10006, *Standard Operating Procedures for Soil Sampling*.

END OF DOCUMENT



Attachment No. 3

Revised Tables

Table 4-1	Confirmatory Sampling Summary
Table 4-2	Detailed Confirmatory Sampling Summary by Remediation Area
Table 4-3	Extraction Method Summary
Table 4-4	Quality Control Analyses Summary
Table 4-5	Required Containers, Preservatives, and Analysis Holding Times for Solid, Aqueous, and Vapor Samples
Table 5-1	Recommended Project Specific Practical Quantitation Limits for Constituents for Which Analysis may be Conducted
Table 5-2	Recommended Accuracy and Precision Data Quality Objectives
Table 5-3	Recommended Matrix Spike and Laboratory Control Sample Precision and Accuracy Objectives
Table 5-4	Quality Assurance Project Plan - Field Calibration Frequency
Table 5-5	Quality Assurance Project Plan - Field Measurements Quality Control

Table 4-1

**Willow Brook and Willow Brook Pond
East Hartford, Connecticut**

**Field Sampling Plan
Confirmatory Sampling Summary**

Sample Type	Sample Media	Anticipated Number of Samples	Laboratory Analytical Methods (USEPA)
Confirmatory	Soil/Sediment	197	SW846-8082, Rev. December 1996 (PCB)
Confirmatory	Soil/Sediment	76	SW-846-8260B Rev. December 1996 (VOC) SW-846-8270C Rev. December 1995 (SVOC) SW-846-1312 Rev. September 1994 (SPLP) SW-846-6010B Rev. December 1996 (ICP Metals) SW-846-7010 Rev. January 1998 (GFAA Metals) SW-846-7471A Rev. January 1998 (Mercury-Cold Vapor) SW-846-9012A Rev. December 1996 (Cyanide) TPH 418.1
Disposal/ Characterization (Possible Methods Required By Disposal Facility)	Soil/Sediment	24 or As Required by Disposal Facility	SW-846-8082, Rev. December 1996 (PCB) SW-846-8260B Rev. December 1996 (VOC) SW-846-8270C Rev. December 1995 (SVOC) SW-846-1312 Rev. September 1994 (SPLP) SW-846-6010B Rev. December 1996 (ICP Metals) SW-846-7010 Rev. January 1998 (GFAA Metals) SW-846-7471A Rev. January 1998 (Mercury-Cold Vapor) SW-846-9012A Rev. December 1996 (Cyanide) TPH 418.1 SW-846-8081A Rev. December 1996 (Pesticides) SW-846-8151A Rev. December 1996 (Herbicides)
Temporary Wastewater Treatment System Effluent	Wastewater	As Required By Permit	VOC: EPA-601 and 602 plus xylenes or EPA624 MTBE: EPA-602 or EPA-624 TPH: EPA 418.1 Metals: EPA-200.7, 239.1 or 239.2 BNA: EPA-625 PAH: EPA-610 PCBs: EPA-608 Cyanide: EPA-335.1; 335.2

Notes:

1. Samples are collected from an interval of 0 to 6 inches below post-remediation surface.
2. PCB = Polychlorinated Biphenyls
VOC = Volatile Organic Compounds
ICP = Inductively Coupled Plasma
MTBE = Methyl tertiary butyl ether
PAH = Polynuclear Hydrocarbons
USEPA = United States Environmental Protection Agency
- SVOC = Semi-Volatile Organic Compounds
SPLP = Synthetic Precipitate Leachate Procedure
TPH = Total Petroleum Hydrocarbons
BNA = Base Neutral and Acid Extractables
GFAA = Graphite Furnace Atomic Absorption Spectrometry
4. Confirmatory concrete sampling and wipe sampling of non-porous materials may be necessary. The number of respective samples will be quantified once the subject areas are unearthed

Table 4-2

**Willow Brook and Willow Brook Pond
East Hartford, Connecticut**

**Field Sampling Plan
Detailed Confirmatory Sampling Summary
by Remediation Area**

Excavation Area	Bottom Composite Samples				Bottom Grab Samples				Sidewall Composite Samples					Sidewall Grab Samples					
	Excavation Area (Square Feet)	# PCB Aliquots	# PCB Composites	Square Feet Per Sample	# PCBs	Square Feet Per Sample	# Other Parameters	Square Feet Per Sample	Perimeter (Feet)	Depth of Excavation (Feet)	# PCB Aliquots	# PCB Composites	Square Feet Per Sample	Perimeter (Feet)	Depth of Excavation (Feet)	# PCBs	Square Feet Per Sample	# Other Parameters	Square Feet Per Sample
1	1,000				1	1,000	1	1,000						120	4	2	240	2	240
2	3,000	10	3	1,000					240	5	20	5	240						
3	1,600	6	2	800					150	5	12	3	250						
4	4,800	10	3	1,600					260	12	40	10	312	260	12	10	312	10	312
5	750	4	1	750					100	5	6	2	250						
6	1,300	6	2	650					130	2	4	1	260						
7	1,100				1	1,100	1	1,100						130	5	3	217	3	217
8	880				1	880	1	880						120	5	2	300	2	300
9	1,100	5	2	550					120	2	4	1	240	140	2	2	140	2	140
10	3,100	6	2	1,550					180	4	12	3	240						
11	26,000	162	17	1,529	17	1,529	17	1,529	540	4	28	7	309	400	4	5	320	5	320
12	1,600	3	1	1,600					200	3	8	2	300						
13	4,200	12	3	1,400					280	3	12	3	280						
14	31,000	86	20	1,550	20	1,550	20	1,550	930	4	48	12	310	930	4	12	310	12	310
15	13,900	39	11	1,264					420	3	20	5	252						
Totals		349	67		40		40				214	54				36		36	
Average (Samples/s.f.)				1,187				1,212					270						263

Notes:

1. Other Parameters: refer to analytical methods as described in Table 4-1, Confirmatory Sampling Summary for details.
2. One PCB bottom aliquot sample will be collected per 400 square foot node. Not more than 4 aliquots will be combined to form 1 bottom composite sample which represents a 1,600 square foot area.
3. One PCB sidewall aliquot sample will be collected per 80 square foot node. Not more than 4 aliquots will be combined to form 1 sidewall composite sample which represents a 320 square foot area.
4. One PCB bottom grab sample will be collected per 1,600 square foot area.
5. One PCB sidewall grab sample will be collected per 320 square foot area.
6. A total of 121 PCB composite samples will be collected which equates to one PCB composite sample per 778 square feet
7. A total of 76 PCB grab samples will be collected which equates to one PCB grab sample per 762 square feet
8. A total of 197 PCB samples will be collected.
9. A total of 76 Other Parameter samples will be collected.
10. Confirmatory concrete sampling and wipe sampling of non-porous materials may be necessary. The number of respective samples will be quantified once the subject areas are unearthed.

Table 4-3

**Willow Brook and Willow Brook Pond
East Hartford, Connecticut**

**Field Sampling Plan
Extraction Method Summary**

Analytes	Analytical Method	Extraction Methods Aqueous Samples	Extraction Methods Soil and Sediment Samples	Extraction Methods Concrete Samples	Extraction Methods Wipe Samples
PCBs	SW-846 Method 8082	3510C	3545	3545	3550
VOCs	SW-846 Method 8260B	5030B	5035	5035	
SVOCs	SW-846 Method 8270C	3510C	3550B	3550B	
RCRA 8 metals (plus copper, nickel and zinc)	SW-846 6010B	3010A	3050B	3050B	
Cyanide	SW-846 9012	9012	9012	9012	
TPH	418.1	418.1	418.1	418.1	
Pesticides	8081A	3510C	3550B	3550B	
Herbicides	8151A	3510C	3550B	3550B	
SPLP	1312	(USE AQUEOUS EXTRACTION METHODS)			
Metals (GFAA)	7010	3020A	3050B	3050B	
Mercury (Cold Vapor)	7470A/7471A	7470A	7471A	7471A	

If sample has less than 5% solids it is considered an aqueous sample. Greater than 5% solids is a soil or sediment sample.

Sulfuric acid cleanup for PCBs = 3665A

Sulfur cleanup for Pesticides & PCBs = 3660B

Forisil cleanup for Pesticides & PCBs = 3620B

Table 4-4

**Willow Brook and Willow Brook Pond
East Hartford, Connecticut**

**Field Sampling Plan
Quality Control Analyses Summary**

Environmental Sample Matrix / Laboratory Parameters	Estimated Environmental Sample Quantity	Field QC Analyses						Estimated Matrix Total	Laboratory QC Analyses								Estimated Overall Total
		Trip Blank		Field Duplicate		Equipment Blank ^a			MS ^a		MSD ^a		SB ^a		PE Sample		
		Freq	No.	Freq	No.	Freq	No.		Freq	No.	Freq	No.	Freq	No.	Freq.	No.	
Post-Excavation Confirmatory Soil/Sediment Samples																	
PCB	197	NA	NA	1/20	10	1/20	10	217	1/20	10	1/20	10	1/20	10	1/20	10	257
SVOC, VOC, TPH, Metals, Cyanide	76	1/Day	15	1/20	4	1/20	4	99	1/20	4	1/20	4	1/20	4	1/20	4	115

Notes:

1. Table assumes that samples will be processed in groups of 20 samples for QC analyses. If smaller sample groups are processed, the one MS/MSD (or MS/laboratory duplicate) per sample delivery group (up to 20 samples) will be prepared for each sample delivery group.
2. These field and laboratory QC analysis shall be performed at a frequency of 1/20 or 1/week, whichever comes first. Table assumes samples will be collected at a rate of 20 samples per week.
3. QA/QC samples will not be collected for disposal characterization samples, or water samples from the temporary on-site water treatment system.
4. PCB = Polychlorinated Biphenyls.
SVOC = Semi-Volatile Organic Compounds
VOC = Volatile Organic Compounds
TPH = Total Petroleum Hydrocarbons
5. NA: Not applicable.
6. Confirmatory concrete sampling for PCBs may be necessary. The number of samples will be quantified once the subject areas are unearthed. Field and laboratory QC analysis will be identical to that of soil/sediment.
7. Confirmatory wipe sampling of non-porous materials for PCBs may be necessary. The number of samples will be quantified once the subject areas are unearthed. Field QC analysis will be identical to that of soil/sediment.

MS = Matrix Spike

MSD = Matrix Spike Duplicate

SB = Surrogate Blank

MSD = Matrix Spike Duplicate

PE = Performance Evaluation Sample

Table 4-5
Required Containers, Preservatives, and Analysis
Holding Times for Solid and Aqueous Samples

Fraction	Soil/Solid Sample	Preservative	Holding Time
TCL Volatiles	2-40 ml glass screw cap vials with Teflon septa	Cool to 4 C.	14 days
TCL Semivolatiles	1-16 oz. glass w/Teflon lined enclosure.	Cool to 4 C.	14 days till extraction/40 days to inject extract
TCL Organochlorine Pesticides/Herbicides/PCBs	from same 16 oz. above	Cool to 4 C.	14 days till extraction/40 days to inject extract
RCRA 8 metals (plus nickel and zinc)	from same 16 oz. above	Cool to 4 C.	28 days Hg & 180 days all other metals
Cyanides	from same 4 oz. above	Cool to 4 C.	14 days
			days to complete analysis
Total Petroleum Hydrocarbons 418.1	from same 16 oz. above	Cool to 4 C.	28 days
Trip Blank, Field Blank or Aqueous Sample			
TCL Volatiles	2-40 ml glass screw cap vials with Teflon septa	HCl to pH <2, Cool to 4 C.	14 days
TCL Semivolatiles	2-1 liter amber glass with Teflon lined cap	Cool to 4 C.	7 days extraction/40 days to inject
TCL Organochlorine Pesticides/Herbicides/PCBs	2-1 liter amber glass with Teflon lined cap	Cool to 4 C.	7 days extraction/40 days to inject
RCRA 8 metals (nickel and zinc)	1-1 liter HDP	HNO to pH<2	28 days Hg & 180 days all other metals
Cyanides	1-1 liter HDP	NaOH to pH >12, Cool to 4 C.	14 days
Total Petroleum Hydrocarbons 418.1	2-1 liter amber glass with Teflon lined cap	Cool to 4 C. pH<2	28 days
Fraction	Wipe Sample (non-porous materials)	Preservative	Holding Time
PCBs	1-4oz glass with teflon lined enclosure gauze pad	hexane Cool to 4 C.	7 days till extraction/40 days to inject extract

1 - Depending on how sample analyses are distributed between the laboratories, additional sample bottles may be required.

2 - Holding times are from the date of sample collection.

Table 5-1

**RECOMMENDED PROJECT SPECIFIC PRACTICAL QUANTITATION LIMITS FOR CONSTITUENTS
FOR WHICH ANALYSIS MAY BE CONDUCTED**

Page 1 of 6

CAS#	Analyte Name	Type	Project Quantitation Limits				
			Method *	Aqueous	Units	Soil **	Units
67-64-1	Acetone	VOA	SW846-8260B	20.0	ug/l	20.0	ug/kg
75-05-8	Acetonitrile	VOA	SW846-8260B	5.0	ug/l	10.0	ug/kg
107-02-8	Acrolein	VOA	SW846-8260B	5.0	ug/l	20.0	ug/kg
107-13-1	Acrylonitrile	VOA	SW846-8260B	1.0	ug/l	10.0	ug/kg
107-05-1	Allyl chloride	VOA	SW846-8260B	5.0	ug/l	10.0	ug/kg
71-43-2	Benzene	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
75-27-4	Bromodichloromethane	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
75-25-2	Bromoform	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
74-83-9	Methyl bromide (bromomethane)	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
78-93-3	Methyl ethyl ketone (2-Butanone)	VOA	SW846-8260B	5.0	ug/l	10.0	ug/kg
75-15-0	Carbon disulfide	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
56-23-5	Carbon tetrachloride	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
108-90-7	Chlorobenzene	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
75-00-3	Chloroethane	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
67-66-3	Chloroform	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
126-99-8	Chloroprene	VOA	SW846-8260B	5.0	ug/l	10.0	ug/kg
74-87-3	Methyl chloride (Chloromethane)	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
124-48-1	Dibromochloromethane	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
96-12-8	1,2-Dibromo-3-chloropropane	VOA	SW846-8260B	0.5	ug/l	5.0	ug/kg
74-95-3	Dibromomethane (methylene bromide)	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
106-93-4	Ethylene dibromide (EDB)	VOA	SW846-8260B	0.5	ug/l	5.0	ug/kg
110-57-6	trans-1,4-Dichloro-2-butene	VOA	SW846-8260B	5.0	ug/l	10.0	ug/kg
75-71-8	Dichlorodifluoromethane	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
75-34-3	1,1-Dichloroethane	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
107-06-2	1,2-Dichloroethane	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
75-35-4	1,1-Dichloroethene	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
156-59-2	cis-1,2-Dichloroethene	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
156-60-5	trans-1,2-Dichloroethene	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
78-87-5	1,2-Dichloropropane	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
542-75-6	1,3-Dichloropropene (total)	VOA	SW846-8260B	1.0	ug/l	10.0	ug/kg
123-91-1	1,4-Dioxane	VOA	SW846-8260B	25.0	ug/l	50.0	ug/kg
100-41-4	Ethylbenzene	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
97-63-2	Ethyl methacrylate	VOA	SW846-8260B	5.0	ug/l	10.0	ug/kg
591-78-6	2-Hexanone	VOA	SW846-8260B	5.0	ug/l	10.0	ug/kg
78-83-1	Isobutyl alcohol	VOA	SW846-8260B	25.0	ug/l	50.0	ug/kg
126-98-7	Methacrylonitrile	VOA	SW846-8260B	5.0	ug/l	10.0	ug/kg
75-09-2	Methylene chloride	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
74-88-4	Methyl iodide	VOA	SW846-8260B	5.0	ug/l	10.0	ug/kg
80-62-6	Methyl methacrylate	VOA	SW846-8260B	5.0	ug/l	10.0	ug/kg
108-10-1	4-Methyl-2-pentanone	VOA	SW846-8260B	5.0	ug/l	10.0	ug/kg
1634-04-4	Methyl-tert-butyl ether	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
107-12-0	Propionitrile	VOA	SW846-8260B	5.0	ug/l	10.0	ug/kg
100-42-5	Styrene	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
630-20-6	1,1,1,2-Tetrachloroethane	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
79-34-5	1,1,2,2-Tetrachloroethane	VOA	SW846-8260B	0.5	ug/l	5.0	ug/kg
127-18-4	Tetrachloroethene	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg

Table 5-1

**RECOMMENDED PROJECT SPECIFIC PRACTICAL QUANTITATION LIMITS FOR CONSTITUENTS
FOR WHICH ANALYSIS MAY BE CONDUCTED**

Page 2 of 6

CAS#	Analyte Name	Type	Project Quantitation Limits				
			Method *	Aqueous	Units	Soil **	Units
108-88-3	Toluene	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
71-55-6	1,1,1-Trichloroethane	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
79-00-5	1,1,2-Trichloroethane	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
79-01-6	Trichloroethene	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
75-69-4	Trichlorofluoromethane	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
108-05-4	Vinyl acetate	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
96-18-4	1,2,3-Trichloropropane	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
75-01-4	Vinyl chloride	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
1330-20-7	Xylenes (total)	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
83-32-9	Acenaphthene	SV	SW846-8270C	5	ug/l	170	ug/kg
208-96-8	Acenaphthylene	SV	SW846-8270C	5	ug/l	170	ug/kg
98-86-2	Acetophenone	SV	SW846-8270C	5	ug/l	170	ug/kg
53-96-3	2-Acetylaminofluorene	SV	SW846-8270C	5	ug/l	170	ug/kg
92-67-1	4-Aminobiphenyl	SV	SW846-8270C	5	ug/l	170	ug/kg
62-53-3	Aniline	SV	SW846-8270C	5	ug/l	170	ug/kg
120-12-7	Anthracene	SV	SW846-8270C	5	ug/l	170	ug/kg
140-57-8	Aramite	SV	SW846-8270C	5	ug/l	170	ug/kg
56-55-3	Benzo[a]anthracene	SV	SW846-8270C	5	ug/l	170	ug/kg
205-99-2	Benzo[b]fluoranthene	SV	SW846-8270C	5	ug/l	170	ug/kg
207-08-9	Benzo[k]fluoranthene	SV	SW846-8270C	5	ug/l	170	ug/kg
191-24-2	Benzo[ghi]perylene	SV	SW846-8270C	5	ug/l	170	ug/kg
50-32-8	Benzo[a]pyrene	SV	SW846-8270C	5	ug/l	170	ug/kg
100-51-6	Benzyl alcohol	SV	SW846-8270C	5	ug/l	170	ug/kg
111-91-1	bis(2-Chloroethoxy) methane	SV	SW846-8270C	5	ug/l	170	ug/kg
111-44-4	bis(2-Chloroethyl)ether	SV	SW846-8270C	5	ug/l	170	ug/kg
108-60-1	2,2'-oxybis(1-chloro-Propane)	SV	SW846-8270C	5	ug/l	170	ug/kg
117-81-7	bis(2-Ethylhexyl)phthalate	SV	SW846-8270C	5	ug/l	170	ug/kg
101-55-3	4-Bromophenyl phenyl ether	SV	SW846-8270C	5	ug/l	170	ug/kg
85-68-7	Butyl benzyl phthalate	SV	SW846-8270C	5	ug/l	170	ug/kg
86-74-8	Carbazole	SV	SW846-8270C	5	ug/l	170	ug/kg
106-47-8	4-Chloroaniline	SV	SW846-8270C	10	ug/l	330	ug/kg
59-50-7	4-Chloro-3-methyl phenol	SV	SW846-8270C	5	ug/l	170	ug/kg
91-58-7	2-Chloronaphthalene	SV	SW846-8270C	5	ug/l	170	ug/kg
95-57-8	2-Chlorophenol	SV	SW846-8270C	5	ug/l	170	ug/kg
7005-72-3	4-Chlorophenyl phenyl ether	SV	SW846-8270C	5	ug/l	170	ug/kg
218-01-9	Chrysene	SV	SW846-8270C	5	ug/l	170	ug/kg
132-64-9	Dibenzofuran	SV	SW846-8270C	5	ug/l	170	ug/kg
84-74-2	Di-n-butyl phthalate	SV	SW846-8270C	5	ug/l	170	ug/kg
117-84-0	Di-n-octyl phthalate	SV	SW846-8270C	5	ug/l	170	ug/kg
53-70-3	Dibenz[a,h]anthracene	SV	SW846-8270C	5	ug/l	170	ug/kg
95-50-1	1,2-Dichlorobenzene	SV	SW846-8270C	5	ug/l	170	ug/kg
541-73-1	1,3-Dichlorobenzene	SV	SW846-8270C	5	ug/l	170	ug/kg
106-46-7	1,4-Dichlorobenzene	SV	SW846-8270C	5	ug/l	170	ug/kg
91-94-1	3,3-Dichlorobenzidine	SV	SW846-8270C	5	ug/l	170	ug/kg
120-83-2	2,4-Dichlorophenol	SV	SW846-8270C	5	ug/l	170	ug/kg

Table 5-1

**RECOMMENDED PROJECT SPECIFIC PRACTICAL QUANTITATION LIMITS FOR CONSTITUENTS
FOR WHICH ANALYSIS MAY BE CONDUCTED**

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CAS#	Analyte Name	Type	Project Quantitation Limits				
			Method *	Aqueous	Units	Soil **	Units
84-66-2	Diethyl phthalate	SV	SW846-8270C	5	ug/l	170	ug/kg
297-97-2	0,0-Diethyl-0-2-pyrazinyl	SV	SW846-8270C	5	ug/l	170	ug/kg
60-51-5	Dimethoate	SV	SW846-8270C	5	ug/l	170	ug/kg
60-11-7	p-(Dimethylamino)azobenzene	SV	SW846-8270C	5	ug/l	170	ug/kg
57-97-6	7,12-Dimethylbenz(a)anthracene	SV	SW846-8270C	5	ug/l	170	ug/kg
122-09-8	alpha, alpha, -Dimethylphenethylamine	SV	SW846-8270C	25	ug/l	830	ug/kg
119-93-7	3,3-Dimethylbenzidine	SV	SW846-8270C	5	ug/l	170	ug/kg
105-67-9	2,4-Dimethylphenol	SV	SW846-8270C	5	ug/l	170	ug/kg
131-11-3	Dimethyl phthalate	SV	SW846-8270C	5	ug/l	170	ug/kg
99-65-0	1,3-Dinitrobenzene	SV	SW846-8270C	5	ug/l	170	ug/kg
534-52-1	4,6-Dinitro-2-methylphenol	SV	SW846-8270C	5	ug/l	170	ug/kg
51-28-5	2,4-Dinitrophenol	SV	SW846-8270C	5	ug/l	170	ug/kg
121-14-2	2,4-Dinitrotoluene	SV	SW846-8270C	5	ug/l	170	ug/kg
606-20-2	2,6-Dinitrotoluene	SV	SW846-8270C	5	ug/l	170	ug/kg
117-84-0	Di-n-octyl phthalate	SV	SW846-8270C	5	ug/l	170	ug/kg
88-85-7	Dinoseb	SV	SW846-8270C	5	ug/l	170	ug/kg
122-39-4	Diphenylamine	SV	SW846-8270C	5	ug/l	170	ug/kg
298-04-4	Disulfoton	SV	SW846-8270C	5	ug/l	170	ug/kg
65-50-0	Ethyl methanesulfonate	SV	SW846-8270C	5	ug/l	170	ug/kg
52-85-7	Famphur	SV	SW846-8270C	5	ug/l	170	ug/kg
206-44-0	Fluoranthene	SV	SW846-8270C	5	ug/l	170	ug/kg
86-73-7	Fluorene	SV	SW846-8270C	5	ug/l	170	ug/kg
118-74-1	Hexachlorobenzene	SV	SW846-8270C	5	ug/l	170	ug/kg
87-68-3	Hexachlorobutadiene	SV	SW846-8270C	5	ug/l	170	ug/kg
77-47-4	Hexachlorocyclopentadiene	SV	SW846-8270C	5	ug/l	170	ug/kg
67-72-1	Hexachloroethane	SV	SW846-8270C	5	ug/l	170	ug/kg
70-30-4	Hexachlorophene	SV	SW846-8270C	5	ug/l	170	ug/kg
1888-71-7	Hexachloropropene	SV	SW846-8270C	5	ug/l	170	ug/kg
193-39-5	Indeno(1,2,3-cd)pyrene	SV	SW846-8270C	5	ug/l	170	ug/kg
78-59-1	Isophorone	SV	SW846-8270C	5	ug/l	170	ug/kg
120-58-1	Isosafrole	SV	SW846-8270C	5	ug/l	170	ug/kg
91-80-5	Methapyrilene	SV	SW846-8270C	5	ug/l	170	ug/kg
56-49-5	3-Methylcholanthrene	SV	SW846-8270C	5	ug/l	170	ug/kg
66-27-3	Methyl methanesulfonate	SV	SW846-8270C	5	ug/l	170	ug/kg
91-57-6	2-Methylnaphthalene	SV	SW846-8270C	5	ug/l	170	ug/kg
95-48-7	2-Methylphenol (o-Cresol)	SV	SW846-8270C	5	ug/l	170	ug/kg
108-39-4	3-Methylphenol ((m-Cresol)	SV	SW846-8270C	5	ug/l	170	ug/kg
106-44-5	4-Methylphenol (p-Cresol)	SV	SW846-8270C	5	ug/l	170	ug/kg
298-00-0	Methyl parathion	SV	SW846-8270C	5	ug/l	170	ug/kg
91-20-3	Naphthalene	SV	SW846-8270C	5	ug/l	170	ug/kg
130-15-4	1,4-Naphthoquinone	SV	SW846-8270C	5	ug/l	170	ug/kg
134-32-7	1-Naphthylamine	SV	SW846-8270C	5	ug/l	170	ug/kg
91-59-8	2-Naphthylamine	SV	SW846-8270C	5	ug/l	170	ug/kg
88-74-4	2-Nitroaniline	SV	SW846-8270C	10	ug/l	330	ug/kg
99-09-2	3-Nitroaniline	SV	SW846-8270C	10	ug/l	330	ug/kg
100-01-6	4-Nitroaniline	SV	SW846-8270C	10	ug/l	330	ug/kg

Table 5-1

**RECOMMENDED PROJECT SPECIFIC PRACTICAL QUANTITATION LIMITS FOR CONSTITUENTS
FOR WHICH ANALYSIS MAY BE CONDUCTED**

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CAS#	Analyte Name	Type	Project Quantitation Limits				
			Method *	Aqueous	Units	Soil **	Units
98-95-3	Nitrobenzene	SV	SW846-8270C	5	ug/l	170	ug/kg
56-57-5	4-Nitroquinoline-1-oxide	SV	SW846-8270C	5	ug/l	170	ug/kg
88-75-5	2-Nitrophenol	SV	SW846-8270C	5	ug/l	170	ug/kg
100-02-7	4-Nitrophenol	SV	SW846-8270C	5	ug/l	170	ug/kg
55-18-5	N-Nitrosodiethylamine	SV	SW846-8270C	5	ug/l	170	ug/kg
62-75-9	N-Nitrosodimethylamine	SV	SW846-8270C	5	ug/l	170	ug/kg
86-30-6	N-Nitrosodiphenylamine	SV	SW846-8270C	5	ug/l	170	ug/kg
621-64-7	N-Nitrosodi-n-propylamine	SV	SW846-8270C	5	ug/l	170	ug/kg
924-16-3	N-Nitrosodi-n-butylamine	SV	SW846-8270C	5	ug/l	170	ug/kg
10595-95-6	N-Nitrosomethylethylamine	SV	SW846-8270C	5	ug/l	170	ug/kg
59-89-2	N-Nitrosomorpholine	SV	SW846-8270C	5	ug/l	170	ug/kg
100-75-4	N-Nitrosopiperidenemethylethylamine	SV	SW846-8270C	5	ug/l	170	ug/kg
930-55-2	N-Nitrosopyrrolidine	SV	SW846-8270C	5	ug/l	170	ug/kg
99-55-8	5-Nitro-0-toluidine	SV	SW846-8270C	5	ug/l	170	ug/kg
56-38-2	Parathion	SV	SW846-8270C	5	ug/l	170	ug/kg
608-93-5	Pentachlorobenzene	SV	SW846-8270C	5	ug/l	170	ug/kg
76-01-7	Pentachloroethane	SV	SW846-8270C	5	ug/l	170	ug/kg
82-68-8	Pentachloronitrobenzene	SV	SW846-8270C	5	ug/l	170	ug/kg
87-86-5	Pentachlorophenol	SV	SW846-8270C	5	ug/l	170	ug/kg
62-44-2	Phenacetin	SV	SW846-8270C	5	ug/l	170	ug/kg
85-01-8	Phenanthrene	SV	SW846-8270C	5	ug/l	170	ug/kg
108-95-2	Phenol	SV	SW846-8270C	5	ug/l	170	ug/kg
106-50-3	p-Phenylenediamine	SV	SW846-8270C	100	ug/l	3300	ug/kg
298-02-2	Phorate	SV	SW846-8270C	5	ug/l	170	ug/kg
109-06-8	2-Picoline	SV	SW846-8270C	5	ug/l	170	ug/kg
23950-58-5	Pronamide	SV	SW846-8270C	5	ug/l	170	ug/kg
129-00-0	Pyrene	SV	SW846-8270C	5	ug/l	170	ug/kg
110-86-1	Pyridine	SV	SW846-8270C	5	ug/l	170	ug/kg
94-59-7	Safrole	SV	SW846-8270C	5	ug/l	170	ug/kg
3689-24-5	Sulfotepp	SV	SW846-8270C	5	ug/l	170	ug/kg
95-94-3	1,2,4,5-Tetrachlorobenzene	SV	SW846-8270C	5	ug/l	170	ug/kg
58-90-2	2,3,4,6-Tetrachlorophenol	SV	SW846-8270C	5	ug/l	170	ug/kg
95-53-4	0-Toluidine	SV	SW846-8270C	5	ug/l	170	ug/kg
120-82-1	1,2,4-Trichlorobenzene	SV	SW846-8270C	5	ug/l	170	ug/kg
95-95-4	2,4,5-Trichlorophenol	SV	SW846-8270C	5	ug/l	170	ug/kg
88-06-2	2,4,6-Trichlorophenol	SV	SW846-8270C	5	ug/l	170	ug/kg
126-68-1	0,0,0-Triethylphosphorothioate	SV	SW846-8270C	5	ug/l	170	ug/kg
99-35-4	1,3,5-Trinitrobenzene	SV	SW846-8270C	5	ug/l	170	ug/kg
12674-11-2	Aroclor-1016 +	PCB	SW846-8082	0.4	ug/l	13	ug/kg
11104-28-2	Aroclor-1221 +	PCB	SW846-8082	0.4	ug/l	13	ug/kg
11141-16-5	Aroclor-1232 +	PCB	SW846-8082	0.4	ug/l	13	ug/kg
53469-21-9	Aroclor-1242 +	PCB	SW846-8082	0.4	ug/l	13	ug/kg
12672-29-6	Aroclor-1248 +	PCB	SW846-8082	0.4	ug/l	13	ug/kg
11097-69-1	Aroclor-1254 +	PCB	SW846-8082	0.4	ug/l	13	ug/kg
11096-82-5	Aroclor-1260 +	PCB	SW846-8082	0.4	ug/l	13	ug/kg

Table 5-1

**RECOMMENDED PROJECT SPECIFIC PRACTICAL QUANTITATION LIMITS FOR CONSTITUENTS
FOR WHICH ANALYSIS MAY BE CONDUCTED**

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CAS#	Analyte Name	Type	Project Quantitation Limits				
			Method *	Aqueous	Units	Soil **	Units
57-74-9	Chlordane (TCLP)	OP	SW846-8081A	2	ug/l	2	ug/l
72-20-8	Endrin (TCLP)	OP	SW846-8081A	0.4	ug/l	0.4	ug/l
76-44-8	Heptachlor (TCLP)	OP	SW846-8081A	0.4	ug/l	0.4	ug/l
1024-57-3	Heptachlor Epoxide (TCLP)	OP	SW846-8081A	0.4	ug/l	0.4	ug/l
58-89-9	Lindane (TCLP)	OP	SW846-8081A	0.4	ug/l	0.4	ug/l
72-43-5	Methoxychlor (TCLP)	OP	SW846-8081A	0.4	ug/l	0.4	ug/l
8001-35-2	Toxaphene (TCLP)	OP	SW846-8081A	0.2	ug/l	0.2	ug/l
94-75-7	2,4-D (TCLP)	H	SW846-8151A	20	ug/l	20	ug/l
	2,4,5-TP (Silvex) (TCLP)	H	SW846-8151A	20	ug/l	20	ug/l
7440-38-2	Arsenic	M	SW846-7000A	2.0	ug/l	0.10	mg/kg
7440-39-3	Barium	M	SW846-6010B	10.0	ug/l	0.50	mg/kg
7440-43-9	Cadmium	M	SW846-7000A	2.0	ug/l	0.10	mg/kg
7440-47-3	Chromium (total)	M	SW846-6010B	10.0	ug/l	0.50	mg/kg
7439-97-6	Mercury	M	SW846-7471A	0.20	ug/l	0.010	mg/kg
7439-92-1	Lead	M	SW846-7000A	2.0	ug/l	0.10	mg/kg
7440-22-4	Silver	M	SW846-6010B	2.0	ug/l	0.10	mg/kg
7782-49-2	Selenium	M	SW846-6010B/7000A	10.0/2.0	ug/l	0.5/0.1	mg/kg
7440-02-0	Nickel	M	SW846-6010B	10.0	ug/l	0.50	mg/kg
7440-66-6	Zinc	M	SW846-6010B	10.0	ug/l	0.50	mg/kg
7440-36-0	Antimony - SPLP/TCLP	M	1311/1312-6010B		N/A	0.20	mg/l
7440-38-2	Arsenic - SPLP/TCLP	M	1311/1312-7000A		N/A	0.10	mg/l
7440-39-3	Barium - SPLP/TCLP	M	1311/1312-6010B		N/A	0.010	mg/l
7440-41-7	Beryllium - SPLP/TCLP	M	1311/1312-6010B		N/A	0.002	mg/l
7440-43-9	Cadmium - SPLP/TCLP	M	1311/1312-6010B		N/A	0.010	mg/l
7440-47-3	Chromium (total) - SPLP/TCLP	M	1311/1312-6010B		N/A	0.025	mg/l
7440-50-8	Copper - SPLP/TCLP	M	1311/1312-6010B		N/A	0.025	mg/l
7439-92-1	Lead - SPLP/TCLP	M	1311/1312-7000A		N/A	0.050	mg/l
7439-97-6	Mercury - SPLP/TCLP	M	1311/1312-7471		N/A	0.0002	mg/l
7440-02-0	Nickel - SPLP/TCLP	M	1311/1312-6010B		N/A	0.025	mg/l
7782-49-2	Selenium - SPLP/TCLP	M	1311/1312-7000A		N/A	0.10	mg/l
7440-22-4	Silver - SPLP/TCLP	M	1311/1312-6010B		N/A	0.010	mg/l
7440-28-0	Thallium SPLP/TCLP	M	1311/1312-7000A		N/A	0.20	mg/l
7440-62-2	Vanadium - SPLP/TCLP	M	1311/1312-6010B		N/A	0.050	mg/l
7440-66-6	Zinc - SPLP/TCLP	M	1311/1312-6010B		N/A	0.050	mg/l
5289290-40-1	Total Petroleum Hydrocarbons	Phy	418.1	0.4	mg/l	100	mg/kg
	Total Petroleum Hydrocarbons	Phy	CT ETPH	0.1	mg/l	3.3	mg/kg
SA0001	Alkalinity (to pH 8.3)	WC	EPA 310.1	1.0	mg/l		mg/kg
SA0002	Total Alkalinity (to pH 4.5)	WC	EPA 310.1	1.0	mg/l		mg/kg
SA0003	Ammonia	WC	EPA 350.2	0.020	mg/l	5.0	mg/kg
SA0004	BOD	WC	EPA 405.1	2.0	mg/l		mg/kg

Table 5-1**RECOMMENDED PROJECT SPECIFIC PRACTICAL QUANTITATION LIMITS FOR CONSTITUENTS
FOR WHICH ANALYSIS MAY BE CONDUCTED**

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CAS#	Analyte Name	Type	Project Quantitation Limits			
			Method *	Aqueous	Units	Soil **
SA0006	Chloride	WC	EPA 300.0	2.0	mg/l	
SA0007	COD	WC	EPA 410.2	2.0	mg/l	
SA0008	Cyanide, Total	WC	SW846 9012	0.010	mg/l	0.25
SA0011	Hexavalent Chromium	WC	SW846 7196A	0.050	mg/l	
SA0012	Nitrate/Nitrite	WC	EPA 300.0	0.10	mg/l	
SA0014	Orthophosphate	WC	EPA 365.3	0.020	mg/l	
SA0018	Total Dissolved Solids	WC	EPA 160.1	1.0	mg/l	
SA0019	Total Organic Carbon	WC	EPA 415.1/Kahn	1.0	mg/l	
SA0023	Total Sulfate	WC	EPA 300.0	1.0	mg/l	
SA0024	Total Suspended Solids	WC	EPA 160.2	1.0	mg/l	

NOTES:

(1) Fractions: VOA (Volatile Organic), DAI (Direct Aqueous Injection), SV (Semivolatile Organic), PCB (Polychlorinated biphenyls)

OP (Organophosphorus Pesticide), H (Herbicide), M (Metal), Phy (Physical), and

WC (Wet Chemistry Parameter)

(2) Fictitious CAS number created to represent the coeluting isomers 3-methylphenol and 4-methylphenol.

(3) These are recommended quantitation limits. The final Practical Quantitation limits will be at a concentration to comply with the appropriate Connecticut Remedial Standard Regulations criteria or the selected laboratory's lowest reporting limit, whichever is lower.

SW-846 - "Test Methods for Evaluating Solid Waste, Physical Chemical Methods," third edition.

EPA - "Methods for Chemical Analysis of Water and Wastes," EPA 600 4/79-020

CT-ETPH - "Analysis of Extractable Petroleum hydrocarbons (ETPH) Using Methylene Chloride Gas Chromatograph/Flame

Ionization Detector"

* For 8260B analysis the medium level soil PQL's are 50 times higher than the aqueous limits

** Soil includes sediment and concrete chip samples

+ Wipe sampling may be conducted for PCBs. The practical quantitation limits for each Aroclor will be 0.4 µg/100 cm².

Table 5-2

RECOMMENDED ACCURACY AND PRECISION DATA QUALITY OBJECTIVES

Page 1 of 3

Parameter	Audit	Compounds	Aqueous Control Limits	Solid Control Limits
TCL Volatile Compounds	Lab blank, trip blank, or field blank	All TCL Compounds	<5X the QL or methylene chloride, and <QL for all other compounds	<5X the QL or methylene chloride, and <QL for all other compounds
	Matrix Spike Duplicate Precision	All TCL Compounds	Table 5-3	Table 5-3
	Matrix Spike Recovery	All TCL Compounds	Table 5-3	Table 5-3
	Laboratory Control Sample Recovery	All TCL Compounds	Table 5-3	Table 5-3
	Surrogate Spike Recoveries	4-Bromofluorobenzene Dibromofluoromethane Toluene-d8 Dichloroethane-d4	86-115% 86-118% 88-110% 80-120%	74-121% 80-120% 81-117% 80-120%
TCL Semivolatile Compounds	Lab blank, trip blank, or field blank	All TCL Compounds	<QL for all compounds	<QL for all compounds
	Matrix Spike Duplicate Precision	All TCL Compounds	Table 5-3	Table 5-3
	Matrix Spike Recovery	All TCL Compounds	Table 5-3	Table 5-3
	Laboratory Control Sample Recovery	All TCL Compounds	Table 5-3	Table 5-3

Table 5-2

RECOMMENDED ACCURACY AND PRECISION DATA QUALITY OBJECTIVES

Page 2 of 3

Parameter	Audit	Compounds	Aqueous Control Limits	Solid Control Limits
	Surrogate Spike Recoveries	Nitrobenzene-d5 2-Fluorobiphenyl p-Terphenyl-d14 Phenol-d6 Phenol-d5 2-Fluorophenol 2,4,6-Tribromophenol 4,4-Dibromobiphenyl (Spiked onto cartridge before it is sent to the field.)	35-114% 43-116% 33-141% 10-94% 10-115% 21-100% 10-123% NA	23-120% 30-115% 18-137% 24-113% 24-113% 25-121% 19-121% NA
TCL Pesticides/ PCB Compounds *	Lab blank, trip blank, or field blank	All TCL Compounds	<QL for all compounds	<QL for all compounds
	Matrix Spike Duplicate Precision	All TCL Compounds	Table 5-3	Table 5-3
	Matrix Spike Recovery	All TCL Compounds	Table 5-3	Table 5-3
	Laboratory Control Sample Recovery	All TCL Compounds	Table 5-3	Table 5-3
	Surrogate Spike Recoveries	Tetrachloror-meta-xylene decachlorobiphenyl	60-150% 60-150%	60-150% 60-150%
RCRA 8 Metals plus nickel and zinc	Lab blank, trip blank, or field blank	All TCL Compounds	<PRDL for all compounds	<PRDL for all compounds
	Laboratory Duplicate Precision	All TCL Compounds	Table 5-3	Table 5-3
	Matrix Spike Recovery	All TCL Compounds	Table 5-3	Table 5-3
	Laboratory Control Sample Recovery	All Metals	Table 5-3	Table 5-3

Table 5-2
RECOMMENDED ACCURACY AND PRECISION DATA QUALITY OBJECTIVES

Page 3 of 3

Parameter	Audit	Compounds	Aqueous Control Limits	Solid Control Limits
All Wet Chemistry Parameters	Lab blank, trip blank, or field blank	All Parameters	<QL for all compounds	<QL for all compounds
	Laboratory Duplicate Precision	All Parameters	Table 5-3	Table 5-3
	Matrix Spike Recovery	All Parameters	Table 5-3	Table 5-3
	Laboratory Control Sample Recovery	All Parameters	Table 5-3	Table 5-3

Notes:

QL = Quantitation limit; PRDL = Project required detection Limit; TCL = TargetCompound List; NA= Not Applicable

VOC and SVOC surrogate recoveries updated to reflect most current method specifications on 5/5/01

* Wipe sampling may be conducted for PCBs. The lab control sample recovery (accuracy) will be as defined in Table 5-3. The surrogate spike recoveries will be 60 - 150% for Tetrachloror-meta-xylene and decachlorobiphenyl.

Table 5-3
RECOMMENDED MATRIX SPIKE AND LABORATORY CONTROL SAMPLE
PRECISION AND ACCURACY OBJECTIVES

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CAS#	Analyte Name	Aqueous			Solid/Soil		
		MS/MSD % Recovery	MS/MSD or LD % RPD	LCS% Recovery	MS/MSD % Recovery	MS/MSD or LD % RPD	LCS% Recovery
67-64-1	Acetone	36-132	15	36-132	33-138	40	33-138
71-43-2	Benzene	50-150	15	50-150	42-167	40	42-167
75-27-4	Bromodichloromethane	19-146	15	19-146	45-453	40	45-453
75-25-2	Bromoform	29-141	15	29-141	42-153	40	42-153
74-83-9	Methyl bromide	13-174	15	13-174	34-164	40	34-164
78-93-3	Methyl ethyl ketone	35-153	15	35-153	46-146	40	46-146
75-15-0	Carbon disulfide	14-171	15	14-171	39-153	40	39-153
56-23-5	Carbon tetrachloride	52-151	15	52-151	42-168	40	42-168
108-90-7	Chlorobenzene	54-149	15	54-149	43-164	40	43-164
75-00-3	Chloroethane	16-167	15	16-167	31-160	40	31-160
67-66-3	Chloroform	56-152	15	56-152	46-160	40	46-160
74-87-3	Methyl chloride	30-170	15	30-170	25-175	40	25-175
124-48-1	Chlorodibromomethane	33-150	15	33-150	44-151	40	44-151
75-34-3	1,1-Dichloroethene	36-166	15	36-166	44-164	40	44-164
107-06-2	1,2-Dichloroethene	52-149	15	52-149	46-160	40	46-160
75-35-4	1,1-Dichloroethane	22-181	15	22-181	52-166	40	52-166
540-59-0	1,2-Dichloroethane (total)	53-149	15	53-149	43-167	40	43-167
78-87-5	1,2-Dichloropropane	36-164	15	36-164	46-163	40	46-163
10061-01-5	cis-1,3-Dichloropropene	47-140	15	47-140	45-153	40	45-153
10061-02-6	trans-1,3-dichloropropene	27-143	15	27-143	35-19	40	35-19
100-41-4	Ethylbenzene	54-157	15	54-157	45-172	40	45-172
591-78-6	Methyl butyl ketone	34-141	15	34-141	55-134	40	55-134
75-09-2	Methylene chloride	52-156	15	52-156	41-181	40	41-181
108-10-1	Methyl isobutyl ketone	45-119	15	45-119	54-128	40	54-128
100-42-5	Styrene	44-153	15	44-153	76-132	40	76-132
79-34-5	1,1,2,2-Tetrachloroethane	40-139	15	40-139	43-148	40	43-148
127-18-4	Tetrachloroethene	51-165	15	51-165	43-183	40	43-183
108-88-3	Toluene	49-156	15	49-156	44-170	40	44-170
71-55-6	1,1,1-Trichloroethane	1-144	15	1-144	45-166	40	45-166
79-00-5	1,1,2-Trichloroethane	48-142	15	48-142	44-156	40	44-156
79-01-6	Trichloroethene	36-159	15	36-159	42-169	40	42-169
75-01-4	Vinyl chloride	38-168	15	38-168	31-176	40	31-176
1330-20-7	Xylenes (total)	52-150	15	52-150	42-162	40	42-162

Table 5-3
RECOMMENDED MATRIX SPIKE AND LABORATORY CONTROL SAMPLE
PRECISION AND ACCURACY OBJECTIVES

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CAS#	Analyte Name	Aqueous			Solid/Soil		
		MS/MSD % Recovery	MS/MSD or LD % RPD	LCS% Recovery	MS/MSD % Recovery	MS/MSD or LD % RPD	LCS% Recovery
83-32-9	Acenaphthene	58-108	20	58-108	46-117	40	46-117
208-96-8	Acenaphthylene	50-112	20	50-112	43-116	40	43-116
120-12-7	Anthracene	59-104	20	59-104	41-121	40	41-121
56-55-3	Benzo[a]anthracene	61-111	20	61-111	48-124	40	48-124
205-99-2	Benzo[b]fluoranthene	55-114	20	55-114	40-134	40	40-134
207-08-9	Benzo[k]fluoranthene	50-126	20	50-126	41-134	40	41-134
191-24-2	Benzo[ghi]perylene	57-137	20	57-137	35-147	40	35-147
50-32-8	Benzo[a]pyrene	48-123	20	48-123	42-137	40	42-137
111-91-1	bis(2-Chloroethoxy)methane	47-109	20	47-109	41-117	40	41-117
111-44-4	bis(2-Chloroethyl)ether	53-102	20	53-102	39-116	40	39-116
108-60-1	bis(2-Chloroisopropyl)ether	42-117	20	42-117	65-108	40	65-108
117-81-7	bis(2-Ethylhexyl)phthalate	55-122	20	55-122	45-132	40	45-132
101-55-3	4-Bromophenyl phenyl ether	60-106	20	60-106	46-123	40	46-123
85-68-7	Butyl benzyl phthalate	49-119	20	49-119	48-135	40	48-135
106-47-8	4-Chloroaniline	49-99	20	49-99	D.L.-123	40	D.L.-123
59-50-7	4-Chloro-3-methylphenol	58-111	20	58-111	48-117	40	48-117
91-58-7	2-Chloronaphthalene	55-105	20	55-105	45-117	40	45-117
95-57-8	2-Chlorophenol	56-101	20	56-101	43-114	40	43-114
7005-72-3	4-Chlorophenyl phenyl ether	54-108	20	54-108	49-117	40	49-117
218-01-9	Chrysene	58-115	20	58-115	48-12+6	40	48-12+6
132-64-9	Dibenzofuran	55-113	20	55-113	67-103	40	67-103
84-74-2	Di-n-butyl phthalate	54-115	20	54-115	43-126	40	43-126
53-70-3	Dibenz[a,h]anthracene	50-146	20	50-146	45-154	40	45-154
95-50-1	1,2-Dichlorobenzene	47-98	20	47-98	39-112	40	39-112
541-73-1	1,3-Dichlorobenzene	43-94	20	43-94	37-112	40	37-112
106-46-7	1,4-Dichlorobenzene	43-94	20	43-94	39-110	40	39-110
91-94-1	3,3-Dichlorobenzidine	52-112	20	52-112	19-117	40	19-117
120-83-2	2,4-Dichlorophenol	56-105	20	56-105	46-117	40	46-117
84-66-2	Diethyl phthalate	48-115	20	48-115	49-127	40	49-127
105-67-9	2,4-Dimethylphenol	52-94	20	52-94	33-113	40	33-113
131-11-3	Dimethyl phthalate	25-106	20	25-106	49-123	40	49-123

Table 5-3
RECOMMENDED MATRIX SPIKE AND LABORATORY CONTROL SAMPLE
PRECISION AND ACCURACY OBJECTIVES

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CAS#	Analyte Name	Aqueous			Solid/Soil		
		MS/MSD % Recovery	MS/MSD or LD % RPD	LCS% Recovery	MS/MSD % Recovery	MS/MSD or LD % RPD	LCS% Recovery
534-52-1	4,6-Dinitro-2-methylphenol	53-117	20	53-117	28-147	40	28-147
51-28-5	2,4-Dinitrophenol	43-131	20	43-131	9-167	40	9-167
121-14-2	2,4-Dinitrotoluene	56-118	20	56-118	48-126	40	48-126
606-20-2	2,6-Dinitrotoluene	56-106	20	56-106	47-122	40	47-122
117-84-0	Di-n-octyl phthalate	44-140	20	44-140	35-150	40	35-150
206-44-0	Fluoranthene	53-115	20	53-115	44-121	40	44-121
86-73-7	Fluorene	51-113	20	51-113	46-115	40	46-115
118-74-1	Hexachlorobenzene	63-108	20	63-108	44-126	40	44-126
87-68-3	Hexachlorobutadiene	30-85	20	30-85	41-117	40	41-117
77-47-4	Hexachlorocyclopentadiene	D.L.-132	20	D.L.-132	D.L.-125	40	D.L.-125
67-72-1	Hexachloroethane	35-83	20	35-83	39-110	40	39-110
193-39-5	Indeno(1,2,3-cd)pyrene	48-141	20	48-141	44-151	40	44-151
78-59-1	Isophorone	54-106	20	54-106	41-115	40	41-115
91-57-6	2-Methylnaphthalene	49-104	20	49-104	61-99	40	61-99
95-48-7	2-Methylphenol	47-87	20	47-87	58-114	40	58-114
91-20-3	Naphthalene	50-108	20	50-108	41-115	40	41-115
88-74-4	2-Nitroaniline	59-112	20	59-112	74-102	40	74-102
99-09-2	3-Nitroaniline	50-114	20	50-114	47-105	40	47-105
100-01-6	4-Nitroaniline	54-126	20	54-126	37-108	40	37-108
98-95-3	Nitrobenzene	54-106	20	54-106	42-116	40	42-116
88-75-5	2-Nitrophenol	65-112	20	65-112	44-122	40	44-122
100-02-7	4-Nitrophenol	17-68	20	17-68	42-146	40	42-146
86-30-6	N-Nitrosodiphenylamine	33-70	20	33-70	39-125	40	39-125
621-64-7	N-Nitrosodipropylamine	51-112	20	51-112	40-120	40	40-120
87-86-5	Pentachlorophenol	29-135	20	29-135	18-161	40	18-161
85-01-8	Phenanthrene	60-109	20	60-109	43-121	40	43-121
108-95-2	Phenol	28-58	20	28-58	36-121	40	36-121
129-00-0	Pyrene	58-118	20	58-118	46-130	40	46-130
120-82-1	1,2,4-Trichlorobenzene	45-100	20	45-100	42-114	40	42-114
95-95-4	2,4,5-Trichlorophenol	62-118	20	62-118	69-115	40	69-115
88-06-2	2,4,6-Trichlorophenol	50-108	20	50-108	46-118	40	46-118
86-74-8	Carbazole	40-137	20	40-137	35-133	40	35-133

Table 5-3
RECOMMENDED MATRIX SPIKE AND LABORATORY CONTROL SAMPLE
PRECISION AND ACCURACY OBJECTIVES

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CAS#	Analyte Name	Aqueous			Solid/Soil		
		MS/MSD % Recovery	MS/MSD or LD % RPD	LCS% Recovery	MS/MSD % Recovery	MS/MSD or LD % RPD	LCS% Recovery
58-89-9	gamma-BHC/Lindane (TCLP)	NA	NA	NA	10-130	60	15-135
5103-71-9	Chlordane (TCLP)	NA	NA	NA	12-148	68	30-143
72-20-8	Endrin (TCLP)	NA	NA	NA	10-156	73	17-162
76-44-8	Heptachlor (TCLP)	NA	NA	NA	10-125	58	16-136
1024-57-3	Heptachlor epoxide (TCLP)	NA	NA	NA	16-129	57	32-146
72-43-5	Methoxychlor (TCLP)	NA	NA	NA	10-170	80	18-180
94-75-7	2,4-D (TCLP)	NA	NA	NA	20-122	51	20-146
93-72-1	2,4,5-TP (TCLP)	NA	NA	NA	16-108	46	22-110
12674-11-2	Aroclor-1016 *	56-119	20	61-118	26-144	39	49-122
11096-82-5	Aroclor-1260 *	31-138	27	61-124	37-138	33	51-127
7440-38-2	Arsenic	75-125	20	75-125	75-125	20	75-125
7440-39-3	Barium	75-125	20	75-125	75-125	20	75-125
7440-43-9	Cadmium	75-125	20	75-125	75-125	20	75-125
7440-47-3	Chromium	75-125	20	75-125	75-125	20	75-125
7439-92-1	Lead	75-125	20	75-125	75-125	20	75-125
7439-97-6	Mercury	75-125	20	75-125	75-125	20	75-125
7440-02-0	Nickel	75-125	20	75-125	75-125	20	75-125
7440-22-4	Silver	75-125	20	75-125	75-125	20	75-125
7440-66-6	Zinc	75-125	20	75-125	75-125	20	75-125
SA0001	Alkalinity (to pH 8.3)	75-125	20	75-125	75-125	20	75-130
SA0002	Total Alkalinity (to pH 4.5)	75-125	20	75-125	75-125	20	75-130
SA0003	Ammonia	75-125	20	75-125	75-125	20	75-130
SA0004	BOD	75-125	20	75-125	75-125	20	75-130
SA0006	Chloride	75-125	20	75-125	75-125	20	75-130
SA0007	COD	75-125	20	75-125	75-125	20	75-130
SA0008	Cyanide, Total	75-125	20	75-125	75-125	20	75-130

Table 5-3
RECOMMENDED MATRIX SPIKE AND LABORATORY CONTROL SAMPLE
PRECISION AND ACCURACY OBJECTIVES

Page 5 of 5

CAS#	Analyte Name	Aqueous			Solid/Soil		
		MS/MSD % Recovery	MS/MSD or LD % RPD	LCS% Recovery	MS/MSD % Recovery	MS/MSD or LD % RPD	LCS% Recovery
SA0011	Hexavalent Chromium	75-125	20	75-125	75-125	20	75-130
SA0012	Nitrate/Nitrite	75-125	20	75-125	75-125	20	75-130
SA0014	Orthophosphate	75-125	20	75-125	75-125	20	75-130
SA0018	Total Dissolved Solids	75-125	20	75-125	75-125	20	75-130
SA0019	Total Organic Carbon	75-125	20	75-125	75-125	20	75-130
SA0023	Total Sulfate	75-125	20	75-125	75-125	20	75-130
SA0024	Total Suspended Solids	75-125	20	75-125	75-125	20	75-130

NOTES:

(1) Fractions: VOA - Volatile Organic Analytes; DAI - Direct Aqueous Injection; SV - Semivolatile Organics; PCB - polychlorinated biphenyls

OP - Organophosphorus Pesticides; H - Herbicides; M - Metals; WC - Wet Chemistry; RAD - Radiological

(2) Fictitious CAS numbers created to represent the co-eluting isomers 3-methylphenol and 4-methylphenol.

(3) SVOC limits were rounded to whole numbers to reflect the accuracy of the laboratory (5/5/01).

SW-846 - "Test Methods for Evaluating Solid Waste, Physical Chemical Methods," third edition.

EPA - "Methods for Chemical Analysis of Water and Wastes," EPA 600-4/79-020.

(4) These are recommended values for recovery and RPD. The selected analytical laboratory's internal control limits will serve as the final limits for the project.

* LCS % recovery will be 49-122 and 51-127 for Aroclor-1016 and 1260 respectively. MS/MSD % Recovery and % RPD will not be applicable to wipe samples for PCBs.

Table 5-4
Willow Brook and Willow Brook Pond
East Hartford, Connecticut

Quality Assurance Project Plan
Field Calibration Frequency

Equipment	Calibration Check	Calibration Standards	Initial Calibration Frequency
pH Meter	Prior to use-daily, Intermittently throughout the day At end the end of each day	pH 4.0 pH 7.0 pH 10.0	Initial Factory calibration And whenever calibration check no longer meets QC requirements
Dust Monitor	Prior to use-daily	Particle free environment	Initial Factory calibration And whenever calibration check no longer meets QC requirements
Conductivity Meter	Prior to use-daily	1,000 mg/l NaCl	Initial Factory calibration And whenever calibration check no longer meets QC requirements
Water Level Meter	Prior to use-daily	100' engineers' tape	Initial Factory calibration And whenever calibration check no longer meets QC requirements
Organic Vapor Meter	Prior to use-daily, Mid-day and/or following measurement spike and/or following percent drift greater than background	100 ppm Isobutylene	Initial Factory calibration And whenever calibration check no longer meets QC requirements
Turbidity Meter	Prior to use-daily	0.5 NTU	Initial Factory calibration And whenever calibration check no longer meets QC requirements
PCB Immunoassay	Per batch of samples (\leq 20 samples / batch)	1 ppm 10 ppm 25 ppm	Per batch of samples (\leq 20 samples / batch)

Notes:

1. N/A = not applicable.
2. NTU= nephelometric turbidity units.
3. mg/l = milligrams per liter.
4. ppm = parts per million.
5. Specific standard concentrations are selected based on the objective of the remedial activity.
6. Intermittent calibration checks: will be performed on field instrumentation whenever significant measurement spikes and / or percent differences greater than background are encountered.
Intermittent calibration checks may also be performed when significant changes in temperature occur or other circumstances which may affect the performance of the instrumentation.
Intermittent calibration checks will be documented in the field paperwork.

Table 5-5

**Willow Brook and Willow Brook Pond
East Hartford, Connecticut**

**Quality Assurance Project Plan
Field Measurements Quality Control**

Field Parameter	Precision¹	Accuracy
Water Temperature	$\pm 1^{\circ} \text{ C}$	$\pm 1^{\circ} \text{ C}$ Instrument Capability
pH	$\pm 0.01 \text{ pH S.U.}$	$\pm 0.01 \text{ pH S.U.}$ (Instrument Capability)
Conductivity	$\pm 1 \text{ }\mu\text{S}$	$\pm 1\%$ of Full Scale or ± 1 digit (greater of the values)
Dissolved Oxygen	$\pm 0.01 \text{ mg/L}$	$\pm 1 \%$ of saturation
Turbidity	$\pm 1.0 \text{ NTU}$	$\pm 2 \%$ Standard
Water Level	$\pm 0.01 \text{ foot}$	$\pm 0.01 \text{ foot}$
Dust Monitor	$\pm 10 \text{ }\mu\text{g/m}^3$ for 1-second averaging	$\pm 5\%$ of reading \pm precision
PCB Immunoassay Test Kit (semi-quantitative screening procedure)	NA	NA

Notes:

1. ¹ = Precision units presented in applicable significant figures.
2. S.U. = standard units
3. mS/cm = millisiemens per centimeter
4. mg/L = milligrams per liter
5. PCB immunoassay is a semi-quantitative method.